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THE UREDINALES, OR RUST-FUNGI, OF NEW ZEALAND.

SUPPLEMENT TO PART 1; AND PART 2.

BY

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The Uredinales, or Rust-fungi, of New Zealand: Supplement to Part 1; and Part 2.

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Plates 1, 2.

SUPPLEMENT TO PART 1 OF THE UREDINALES OF NEW ZEALAND.

Additional Species of the Puccineae.

Since the first part of this paper has been sent to the press the following additional species have come to hand.

This supplement adds ten species of *Puccinia* to the New Zealand Uredinales; of these, two are introduced, one is doubtfully indigenous, and the remainder are endemic.

1. Puccinia Elymi Westendorp. (Fig. 77.) Gramineae.

West., *Bull. Acad. Brux.*, vol. 18, p. 408, 1851.

Aecidium Clematidis DC., *Fl. Fr.*, vol. 2, p. 243, 1805. *A. Aquilegiae* Pers., *Ic. Pict.*, p. 58, 1806. *Uredo Elymi* West., *Bull. Acad. Brux.*, vol. 18, p. 405, 1851. *Puccinia triarticulata* Berk. et Curt., *Proc. Am. Acad. Sci.*, vol. 4, p. 126, 1862. *P. tomipara* Trel., *Trans. Wis. Acad. Sci.*, vol. 6, p. 127, 1885. *P. perplexans* Plowr., *Quart. Jour. Micr. Sci.*, vol. 25, p. 164, 1885. *P. persistens* Plowr., *Brit. Ured.*, p. 180, 1889. *P. Agrostidis* Plowr., *Gard. Chron.*, ser. iii, vol. 8, p. 139, 1890. *P. Agropyri* Ell. et Ev., *Jour. Myc.*, vol. 7, p. 131, 1892. *P. Aquilegiae* Lagerh., *Tromoso Mus. Aarsh.*, vol. 17, p. 47, 1895. *P. Clematidis* Lagerh., *l.c.*, p. 54. *P. adspersa* Diet. et Holw., *Erythea*, vol. 3, p. 81, 1895. *P. triticina* Erikss., *Ann. Sci. Nat.*, ser. viii, vol. 9, p. 270, 1899. *P. agropyrina* Erikss., *l.c.*, p. 273. *P. Actaeae-Agropyri* Ed. Fisch., *Ber. Schweiz. Bot. Ges.*, vol. 11, p. 8, 1901. *P. Panicullariae* Arth., *Bul. Torr. Club*, vol. 28, p. 663, 1901. *P. Triticorum* Speg., *Anal. Mus. Nac. Buenos Aires*, ser. iii, vol. 1, p. 65, 1902. *Dicaeoma Clematidis* Arth., *Res. Sci. Congr. Bot. Vienne*, p. 344, 1906. *D. Paniculare* Arth., *l.c.* *Puccinia cinerea* Arth., *Bull. Torr. Club*, vol. 34, p. 583, 1907. *P. alternans* Arth., *Mycologia*, vol. 1, p. 248, 1909. *P. obliterata* Arth., *l.c.*, p. 250. *P. Actaeae-Elymi* Mayor, *Ann. Myc.*, vol. 9, p. 361, 1911. *Dicaeoma triticinum* Kern, *Trans. Am. Micr. Soc.*, vol. 32, p. 64, 1913. *Puccinia wyomensis* Arth., *Bull. Torr. Club*, vol. 45, p. 143, 1918. *P. missouriensis* Arth., *l.c.*, p. 146, *p.p.*

0. Spermogones epiphyllous. crowded in small groups, seated on inflated areas, immersed, honey-coloured.

I. Aecidia hypophyllous and petiolicolous, crowded in small groups up to 5 mm. diam., seated on somewhat inflated areas, orange. Peridia cylindrical, up to 2 mm. high, 0·1–0·3 mm. diam., margins slightly expanded, not revolute, white, finely laciniate. Spores globose or elliptical, 18–28 × 15–23 mmm. ;* epispore hyaline, densely and minutely verruculose, 1–1·5 mmm. thick, cell-contents granular, yellow.

II. Uredosori amphigenous, scattered or crowded, seated on pallid spots, linear, 0·5–1 mm. long, orange-yellow, pulverulent, surrounded by the ruptured epidermis. Spores subglobose, elliptical or obovate, 28–32 × 23–26 mmm. ; epispore hyaline, finely and closely echinulate, 1–1·5 mmm. thick, cell-contents granular, orange-yellow ; germ-pores scattered, 6–8, conspicuous.

III. Teleutosori amphigenous, chiefly hypophyllous, and culmicolous, scattered or crowded, often confluent, linear, 0·5–2 mm. long, dark chestnut-brown, pulvinate, compact, long covered by the epidermis. Spores elliptic-oblong or subclavate, 40–60 × 15–20 mmm. ; apex acuminate, bluntly rounded, or truncate, thickened up to 10 mmm., darker in colour, base attenuate, basal cell narrower, longer, and lighter in colour than the upper ; slightly constricted at the septum ; epispore smooth, chestnut-brown, 1·5–2 mmm. thick in the upper cell, 1–1·5 mmm. in the lower ; pedicel persistent, hyaline, tinted beneath the spore, short, up to 15 × 6 mmm. ; germ-pore of the upper cell apical, obscure, basal pore immediately beneath the septum, obscure.

X. Mesospores not uncommon, elongate-elliptical, up to 40 × 12 mmm.

Hosts :—

Deyeuxia Forsteri Kunth. On leaves and culms. Herb. No. 739. II, III. Lake Harris track, Otago, 650 m., *W. D. Reid!* 6 May, 1921.

Triticum vulgare Vill. Herb. No. 1268. Ruakura, Auckland, *A. W. Green!* 9 Jan., 1922.

Distribution : Europe ; Asia Minor ; Japan ; North and South America ; Australia.

One host is indigenous and widely spread throughout ; it occurs also in Australia and Tasmania (Cheeseman, 1906, p. 868). The other is widely cultivated throughout the world.

Arthur has by a long series of cultures shown that this species consists of numerous races formerly considered to be distinct species. These so-called species were separated on account of the fact that the aecidia were known to occur on several hosts ; but until the necessary cultural work had been performed by Arthur apparently no attempt had been made to ascertain whether these races were in any way associated. His arrangement of these races under the one species is followed here, and the synonymy given above taken from his paper in *North American Flora*, vol. 7, p. 333, 1920. In this paper he records fifty-nine aecidial hosts (all belonging to the family Ranunculaceae) and ninety-three telial hosts belonging to the Poaceae.

The genus *Rostrupia* Lagerh. was based on abnormal 3–4-celled forms of the teleutospores of this species.

It may be mentioned that Arthur includes here *P. agropyrina* Erikss. and *P. triticina* Erikss., two races formerly included under *P. dispersa* Erikss. et Henn. Although not sufficiently differentiated to separate as distinct species, these two forms may in the uredo stage be separated on account of the ferruginous colour of the uredosori.

* In this article the contraction "mmm." is used for "micromillimetres."

2. Puccinia Foyana n. sp.* (Fig. 78.) Ranunculaceae.

0. Unknown.

I. Aecidia amphigenous, chiefly hypophyllous, in crowded irregular groups, seated on somewhat inflated spots up to 10 mm. diam., orange. Peridia cupulate, 0·5 mm. diam., margins erect, somewhat incurved, white, laciniate. Spores polygonal or elliptical, 22–30 × 15–20 mmm.; epispore hyaline, finely and densely verruculose, 1 mmm. thick, cell-contents vacuolate, orange.

III. Teleutosori amphigenous, petiolicolous and caulicolous, arranged in scattered groups up to 5 mm. diam., bullate, pulverulent, orbicular, 0·25–0·5 mm. diam., long covered, becoming exposed by the longitudinal fissuring of the epidermis. Spores elliptical, less commonly clavate, 42–65 × 22–26 mmm.; apex acuminate, seldom rounded, crowned with a prominent hyaline papilla, slightly (6 mmm.) or not thickened, base rounded or bluntly attenuate; slightly or not constricted at the septum; epispore smooth, bright chestnut-brown, 2·5–3 mmm. thick, cell-contents granular; pedicel deciduous, hyaline, up to 30 × 8 mmm.; germ-pore of the upper cell apical, conspicuous, papillate, basal pore immediately beneath the septum, conspicuous, papillate.

X. Mesospores not uncommon, elliptical, 20–35 × 17–24 mmm.

Host: *Ranunculus Enysii* T. Kirk. On leaves, stems, and petioles. Herb. No. 581. I–III. Cass (Canterbury), 650 m., *N. R. Foy!* 20 Jan., 1922. (Type.)

The host is endemic, and is confined to the mountains of the South Island. (Cheeseman, 1906, p. 14.)

The conspicuous hyaline apical papilla, thick epispore, and large size of the teleutospores, separate this species from *P. contegens* G. H. Cunn.

3. Puccinia namua n. sp. (Text-fig. 79, and Plate 2, fig. 7.) Umbelliferae.

0. Unknown.

I. Aecidia amphigenous and caulicolous, crowded in scattered groups up to 25 mm. long, seated on slightly inflated, discoloured spots, orange. Peridia cupulate, 0·25 mm. diam., 1 mm. high, margins erect, not revolute, laciniate, white. Spores polygonal or subglobose, 18–24 mmm. diam.; epispore tinted yellow, densely and minutely verruculose, 1–1·5 mmm. thick, cell-contents vacuolate, orange.

II. Uredosori amphigenous, chiefly hypophyllous, and caulicolous, on leaves scattered, orbicular, up to 1·5 mm. diam., seated on pallid-yellow spots; on stems linear, up to 3 mm. long, seldom confluent; orange-yellow, bullate, pulverulent, surrounded and partly covered by the ruptured epidermis. Spores elliptical, obovate, seldom globose, 18–30 × 16–22 mmm.; epispore tinted yellow, sparsely and moderately echinulate, 1–1·5 mmm. thick, cell-contents granular, sulphur-yellow; germ-pores 4, equatorial, obscure.

III. Teleutosori similar to the uredosori but chestnut-brown. Spores subclavate or elliptical, 30–40 × 18–26 mmm.; apex rounded, not thickened, base attenuate, lower cell narrower than the upper; slightly constricted at the septum; epispore coarsely warted, chestnut-brown, 2–2·5 mmm. thick, cell-contents granular; pedicel persistent, hyaline, fragile, up to 25 × 7 mmm.; germ-pore of the upper cell apical, conspicuous, basal pore ¾ below the septum, conspicuous.

* Latin diagnoses of new species will be found on pages 10–13.

Host: *Anisotome filifolia* (Hook. f.) Cockayne and Laing. On leaves and stems. Herb. No. 741. I, II. Mount Isobel, Hanmer (Canterbury), 1,000 m., *W. D. Reid!* 4 Nov., 1921. I, II, III. Sugarloaf, Cass (Canterbury), 1,500 m., *W. D. Reid! N. R. Foy!* 20 Jan., 1922.

The host is endemic, and is confined to the mountains of the South Island. (Cheeseman, 1906, p. 218.)

This species is characterized by the coarsely-warted epispore of the teleutospore.

4. **Puccinia whakatipu** n. sp. (Fig. 80.)

0, I. Unknown.

II. Uredosori amphigenous, chiefly hypophyllous, and caulicolous, elliptical, 0·25–1 mm. long, scattered or crowded, bullate, pulverulent, cinnamon-brown, becoming exposed by the longitudinal fissuring of the epidermis. Spores elliptical, obovate, or subglobose, 22–35 × 18–25 mmm.; epispore pallid cinnamon, sparsely and bluntly echinulate, 2 mmm. thick, cell-contents granular, cinnamon; germ-pores 4, equatorial, obscure.

III. Teleutosori similar to the uredosori but dark chestnut-brown. Spores elliptical or subclavate, 30–40 × 20–26 mmm.; apex rounded, not thickened, base rounded, less commonly attenuate, both cells about the same size; slightly constricted at the septum; epispore minutely verruculose, chestnut-brown, 1·5–2 mmm. thick, cell-contents granular; pedicel persistent, hyaline, fragile, up to 30 × 6 mmm.; germ-pore of the upper cell apical, conspicuous, basal pore $\frac{2}{3}$ below the septum, obscure.

Host: *Anistome filifolia* (Hook. f.) Cockayne and Laing. On leaves and stems. Herb. No. 742. II, III. Table Bay, Wakatipu (Otago), 830 m., *W. D. Reid!* 23 May, 1922. (Type.)

This species is separated from the preceding on account of the minutely-verruculose epispore of the teleutospores, sparsely-warted cinnamon-coloured epispore of the uredospores, and different sorus characters. Although both occur on the same host, they show little other than a general resemblance to each other.

5. **Puccinia Anisotominis** n. sp. (Fig. 81.)

0, I. Unknown.

II. Uredosori hypophyllous, crowded on discoloured spots, elliptical, 1–2 mm. long, bullate, pallid ferruginous, long covered. Spores subglobose, elliptical or obovate, 24–40 × 18–22 mmm.; epispore hyaline, sparsely and somewhat coarsely echinulate, 1·5–2 mmm. thick, cell-contents granular, tinted brown; germ-pores 4, equatorial, obscure.

III. Teleutosori amphigenous, chiefly hypophyllous, crowded in scattered groups, elliptical when 1–1·5 mm. long, or confluent and attaining a length of 3 mm., bullate, pulverulent, dark chestnut-brown, long covered, becoming exposed by the longitudinal fissuring of the epidermis. Spores elongate-clavate, 40–60 × 17–22 mmm.; apex bluntly acuminate, seldom rounded, thickened up to 6 mmm., base attenuate, basal cell slightly longer and narrower than the upper; constricted at the septum; epispore smooth, golden-brown, 2–2·5 mmm. thick in upper cell, 1·5–2 mmm. thick in lower, cell-contents granular; pedicel persistent, hyaline, fragile, up to 40 × 7 mmm.; germ-pore of the upper cell apical, conspicuous, basal pore immediately beneath the septum, obscure.

Host: *Anisotome Haastii* (F. v. M.) Cockayne and Laing. On leaves. Herb. No. 743. II, III. Lake Harris track, Otago, 1,000 m., *W. D. Reid!* 6 May, 1921. (Type.)

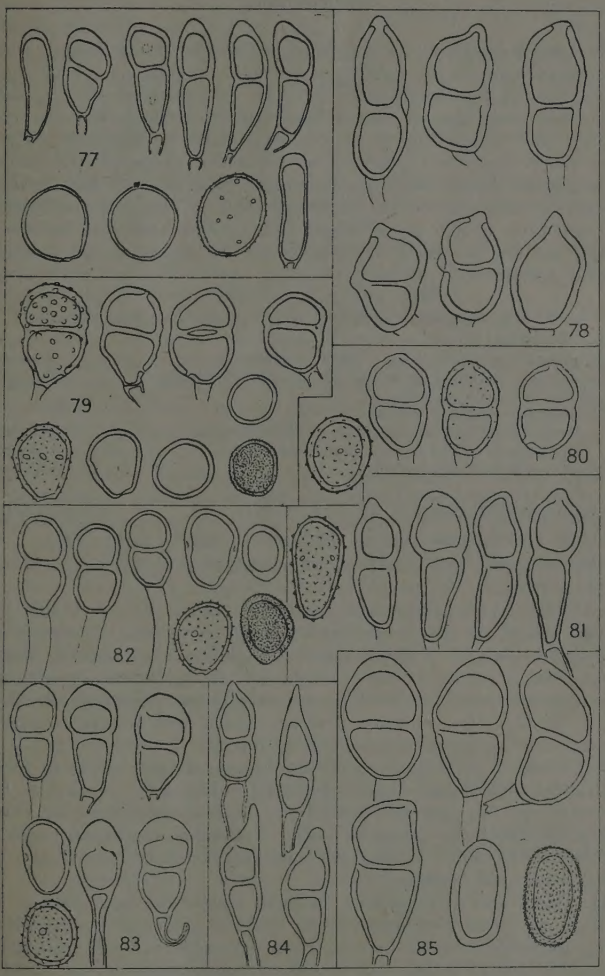

FIG. 77.—*Puccinia Elymi* West. on *Deyeuxia Forsteri* Kunth. Teleutospores, mesospores, and uredospores.

FIG. 78.—*Puccinia Foyana* G. H. Cunn. on *Ranunculus Enysii* T. Kirk. Teleutospores and mesospore.

FIG. 79.—*Puccinia namua* G. H. Cunn. on *Anisotome filifolia* (Hook. f.) Cockayne and Laing. Teleutospores, uredospores, and aecidiospores.

FIG. 80.—*Puccinia whakatipu* G. H. Cunn. on *Anisotome filifolia* (Hook. f.) Cockayne and Laing. Teleutospores and uredospore.

FIG. 81.—*Puccinia Anisotominis* G. H. Cunn. on *Anisotome Haastii* (F. v. M.) Cockayne and Laing. Teleutospores and uredospore.

FIG. 82.—*Puccinia Euphrasiana* G. H. Cunn. on *Euphrasia cuneata* Forst. Teleutospores, uredospores, and aecidiospores.

FIG. 83.—*Puccinia punctata* Link. on *Galium umbrosum* Sol. Teleutospores and uredospores.

FIG. 84.—*Puccinia Wahlenbergiae* G. H. Cunn. on *Wahlenbergia albomarginata* Hook Teleutospores.

FIG. 85.—*Puccinia Sonchi* Rob. on *Sonchus oleraceus* L. Teleutospores and uredospores

All figures × 400.

The host is endemic, and is confined to the South Island, where it is not uncommon in the mountain districts. (Cheeseman, 1906, p. 217.)

This rust is separated from the two preceding species on account of the differently-shaped longer teleutospores (which have a smooth epispore), and much larger coarsely-echinulate uredospores. The five species which have been recorded on the genera *Angelica* and *Anisotome* show a general family resemblance to one another, and may readily be separated by reference to the following table. The presence or absence of an aecidium is not given below as a specific character, as the cycle of those species in which it appears to be absent is at present too imperfectly known.

KEY TO SPECIES OF PUCCINIA ON ANGELICA AND ANISOTOME.

Teleutospores smooth.	
Teleutospores elongate-clavate, 40–60 × 17–2 mmm.	*Anisotominis.*
Teleutospores elliptical or subclavate, 35–45 × 21–26 mmm. ..	*cuniculi.*
Teleutospores variously warted.	
Teleutospores minutely warted.	
Uredospores cinnamon; germ-spores equatorial	*whakatipu.*
Uredospores yellow; germ-pores scattered	*kopoti.*
Teleutospores coarsely warted	*namua.*

6. Puccinia Euphrasiana n. sp. (Fig. 82.) Scrophulariaceae.

Uredo australis Diet. et Neg., *Engler Jahrb.*, vol. 27, p. 15, 1899.

0. Spermogones hypophyllous, immersed, sparse, scattered, associated with the aecidia.

I. Aecidia hypophyllous, in scattered groups up to 5 mm. diam., irregular, seated on discoloured spots which are absent in certain specimens, pallid-orange. Peridia depressed-globose, or angular, flattened, 0·2 mm. diam., immersed and covered by the epidermis, opening by an irregular apical pore, hyaline. Spores subglobose, polygonal or elliptical, 22–30 × 18–22 mmm; epispore hyaline, densely and minutely verruculose, 1·5 mmm thick, cell-contents vacuolate, orange.

II. Uredosori amphigenous, chiefly hypophyllous, scattered, orbicular or elliptical, 0·5–1 mm. diam., bullate, pulverulent, cinnamon-brown, surrounded by the ruptured epidermis. Spores subglobose or elliptical, 20–30 × 18–23 mmm.; epispore pallid cinnamon, moderately and finely echinulate, 1–1·5 mmm. thick, cell-contents vacuolate, cinnamon; germ-pores 2, equatorial, conspicuous.

III. Teleutosori amphigenous, in small scattered groups of 3 or 4 sori, seated on dead and discoloured spots, bullate, pulverulent, dark chestnut-brown, partially covered by the ruptured epidermis. Spores elliptical, seldom subclavate, 28–38 × 15–20 mmm.; apex rounded, not thickened; base slightly attenuate, or rounded, both cells about the same size; constricted at the septum; epispore smooth, chestnut-brown, 1·5 mmm. thick; pedicel persistent, hyaline, up to 50 × 8 mmm.; germ-pore of the upper cell apical, obscure, basal pore immediately beneath the septum, obscure.

Host: *Euphrasia cuneata* Forst. On leaves. Herb. Nos. 727, 744. I, II. York Bay, Wellington, *E. H. Atkinson!* 10 Mar., 1922. II, III. York Bay, *E. H. Atkinson! G. H. C.* 12 July, 1922; 14 Oct., 1922.

Distribution: Chile

The host is endemic, and is not uncommon in the North Island, but is sparingly distributed in the South. (Cheeseman, 1906, p. 553.)

7. Puccinia punctata Link. (Fig. 83.) Rubiaceae.

Link., *Ges. Nat. Freunde Berlin Mag.*, vol. 7, p. 30, 1815.

Puccinia Galii Schw., *Schr. Nat. Ges. Leipsig*, vol. 1, p. 73, 1822. *P. Galiorum* Link., in *Willd. Sp. Pl.*, vol. 6, p. 76, 1825. *Dicaeoma Galiorum* Arth., *Proc. Ind. Acad. Sci.*, 1898, p. 182, 1899. *Puccinia chondroderma* Lindr., *Medd. Stockh. Hogsk. Bot. Ins.*, vol. 4, p. 6, 1901. *Dicaeoma punctatum* (Link.) Arth., *Proc. Ind. Acad. Sci.*, 1903, p. 150, 1904.

0. Spermogones epiphyllous, sparse, in small groups, honey-coloured.

I. Aecidia hypophyllous, in small groups, or scattered, seated on pallid spots, orange-yellow. Peridia cupulate, 0·25 mm. diam., margins short, erect, or somewhat recurved, finely laciniate, white. Spores globose or elliptical, 16–24 × 16–22 mmm.; epispore hyaline, densely and minutely verruculose, 1 mmm. thick, cell-contents orange-yellow.

II. Uredosori amphigenous, chiefly hypophyllous, and caulicolous, on leaves scattered, orbicular, 0·5–1 mm. diam., on stems elliptical, up to 2 mm. long, cinnamon-brown, pulverulent, surrounded by the ruptured epidermis. Spores elliptical, obovate or subglobose, 22–28 × 18–22 mmm.; epispore pallid cinnamon-brown, sparsely and moderately echinulate, 1·5 mmm. thick, cell-contents vacuolate, cinnamon; germ-pores 2, super-equatorial, conspicuous.

III. Teleutosori hypophyllous and caulicolous, minute, orbicular, 0·25–1 mm. diam., chocolate-brown, pulvinate, semi-compact, surrounded by the ruptured epidermis. Spores clavate, less commonly elliptical, 35–50 × 15–22 mmm.; apex rounded, seldom acuminate, thickened up to 14 mmm.; base attenuate, lower cell narrower and lighter in colour than the upper; slightly constricted at the septum; epispore smooth, golden-brown, 2 mmm. thick in upper cell, 1·5 mmm. in lower; pedicel persistent, hyaline, tinted at the apex, up to 40 × 10 mmm.; germ-pore of the upper cell apical, conspicuous, basal pore immediately beneath the septum, obscure.

X. Mesospores common, obovate or elliptical, 25–35 mmm. long.

Hosts:—

Galium umbrosum Sol. On leaves and stems. Herb. No. 745. II, III. Dunstan Mountains (Otago), 600 m., *A. H. Cockayne!* 6 Feb., 1921. II, III. Sandhills, Levin (Wellington), 16 m., *E. H. Atkinson! G. H. C.* 12 Oct., 1922.

Asperula perpusilla Hook. f. Herb. No. 746. I. Glenorchy (Otago), 400 m., *W. D. Reid!* 15 Dec., 1921. Otira Railway-station (Canterbury), *W. Martin!* 10 Feb., 1922. Ben Lomond spur (Otago), *W. D. Reid!* 31 Mar., 1921.

Distribution: Europe; Siberia; North America; Chile.

Both hosts are endemic and common throughout. Cheeseman (1906, p. 267) states that *Asperula perpusilla* would almost be better placed in *Galium*, as the corolla-tube (the only character upon which the genus is separated from *Galium*) is much shorter than is usual in this genus.

Several species are recorded as occurring on *Galium* in Europe. Of these, *P. difformis* K. et S. differs in the uredosori being absent; *P. Valantiae* Pers. in both aecidia and uredosori being absent; and *P. Celakovskyana* Bubak in the absence of aecidia. *P. Asperulae-odoratae* Wurth is separated, as it occurs on *Asperula* and is unable to infect *Galium*; morphologically it is practically identical with *P. punctata*, so that I can see no valid reason for maintaining it other than as a biological form of this latter species.

In Australia McAlpine (1906, pp. 91 and 165) records two rusts, *Uromyces Asperulae* McAlp. and *Puccinia Oliganthae* McAlp., as occurring on *Asperula.* The latter species closely resembles *P. punctata*, but differs in the more acuminate and narrower teleutospore.

In our form the aecidia differ slightly from the European in being amphigenous and caulicolous, but, as the peridial and spore characters are identical, I have thought it better to maintain all spore forms under the one name.

8. Puccinia Wahlenbergiae n. sp. (Fig. 84.) Campanulaceae.

0. Unknown.

III. Teleutosori hypophyllous, caulicolous, and on inflorescences, on leaves orbicular, 1 mm. diam., scattered, on stems linear, 1·5 mm. long compact, pulvinate, pallid brown, naked or surrounded by the ruptured epidermis. Spores fusiform or subclavate, 35–50 × 12–19 mmm.; apex strongly acuminate, thickened up to 18 mmm., base attenuate; slightly or not constricted at the septum; epispore smooth, hyaline, or tinted brown, 1·5–2 mmm. thick, cell-contents vacuolate, tinted brown; pedicel persistent, continuous with the spore, hyaline, stout, up to 30 × 10 mmm.; germ-pore of the upper cell apical, conspicuous, basal pore immediately beneath the septum, obscure.

Host: *Wahlenbergia albomarginata* Hook. On leaves, stems, and inflorescences. Herb. No. 592. III. Tokaanu–Waiouru Road, Taupo, 830 m., *E. H. Atkinson!* 12 Mar., 1922. (Type.)

The host is endemic, and is abundant in hilly and mountainous country throughout. (Cheeseman, 1906, p. 403.)

This rust is characterized by the strongly acuminate apex and persistent stout pedicels of the teleutospores.

9. Puccinia Celmisiae n. sp. (Figs. 86, 121.) Compositae.

Uredo Celmisiae Cke., *Grev.*, vol. 14, p. 89, 1886. *Uredo Compositarum* var. *Celmisiae* Cke., *Grev.*, vol. 19, p. 3, 1890.

0, I. Unknown.

II. Uredosori amphigenous, seated on discoloured spots, orbicular, 1 mm. diam., scattered, or circinnate, when circles up to 5 mm. diam., bullate, pulverulent, reddish-orange, becoming pallid yellow with age, on the lower surface deeply buried in the dense tomentum of the leaf, on the upper surface long covered by the cuticle. Spores globose or obovate, 25–40 × 23–30 mmm.; epispore hyaline, somewhat closely and finely echinulate, 1·5–2 mmm. thick, cell-contents granular, yellow; germ-pores scattered, 6–8, obscure.

III. Teleutosori similar to and arising from the same sori, chestnut-brown. Spores broadly elliptical, 50–62 × 30–36 mmm.; apex rounded, seldom acuminate, not or slightly thickened, base rounded or attenuate, both cells the same size and colour; not or slightly constricted at the septum; epispore smooth, chestnut-brown, 2–3 mmm. thick, cell-contents granular; pedicel deciduous, hyaline, fragile, 30 × 10 mmm.; germ-pore of the upper cell apical, obscure, basal pore immediately beneath or ¼ way below the septum, obscure.

Hosts—

Celmisia coriacea (Forst. f.) Hook. f. On leaves. Herb. Nos. 748, 749. II, III. Mount Isobel, Hanmer (Canterbury), 1,170 m., *W. D. Reid!* 4 Nov., 1921. (Type.) II. Arthur's Pass (Canterbury), *T. Kirk!* (Type uredo material from Kew.) II. Fairfield (Dunedin), *A. W. Bathgate!* 20 June, 1921. II. Jack's Pass, Hanmer (Canterbury), 900 m., *W. D. Reid!* 12 Nov., 1921. Arthur's Pass (Canterbury), *J. G. Myers.* 1 Jan., 1923.

Celmisia Hookeri Cockayne. Herb. No. 747. II. Macraes (Otago), 600 m., *W. D. Reid!* 29 Nov., 1921.

Celmisia longifolia Cass. Herb. No. 764. II. Routeburn Valley (Otago), 800 m., *W. D. Reid!* 7 May, 1921. Lake Harris track (Otago), 1,100 m., *W. D. Reid!* 6 May, 1921. Macraes (Otago), 600 m., *W. D. Reid!* 29 Nov., 1921. Taupo–Tokaanu Road, Taupo, 450 m., *E. H. Atkinson!* 6 Mar., 1922

Celmisia longifolia Cass. var. *alpina* T. Kirk. II. Walter Peak (Otago), 400 m., *W. D. Reid!* 27 April, 1921.

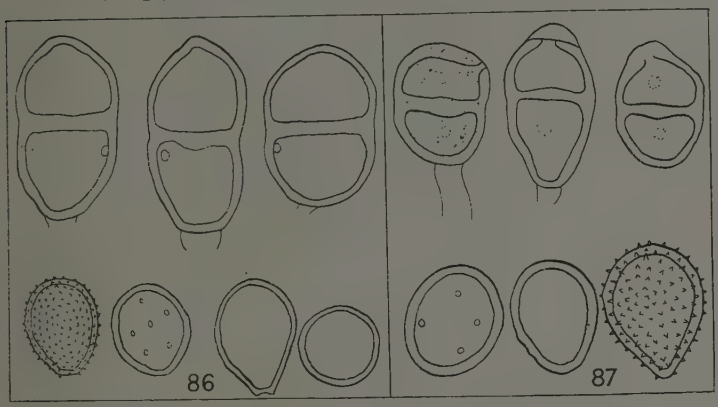

FIG. 86.—*Puccinia Celmisiae* G. H. Cunn. on *Celmisia coriacea* (Forst. f.) Hook. f. Teleutospores and uredospores. × 500.

FIG. 87.—*Puccinia fodiens* G. H. Cunn. on *Celmisia rigida* Cockayne. Teleutospore and uredospores. × 500.

All hosts with the exception of *Celmisia longifolia* Cass. are endemic; the latter species occurs also in Australia and Tasmania (Cheeseman, 1906, pp. 310–314.)

One other rust found on *Celmisia* in New Zealand, *P. fodiens* G. H. Cunn. (fig. 87), closely resembles the species described above, but differs in several particulars. The main differences are tabulated below, and in the text the two illustrations are placed together so that the differences may be observed the more readily.

P. fodiens:—
Uredospores—
Epispore sparsely and coarsely echinulate, 3 mmm. thick.
Teleutospores—
40–55 × 28–35 mmm.; apex acuminate, thickened up to 10 mmm., epispore finely punctate.

P. Celmisiae :—
Uredospores—
Epispore fairly closely and finely echinulate, epispore 1·5–2 mmm. thick
Teleutospores—
50–62 × 30–36 mmm. ; apex rounded, not or slightly thickened, epispore smooth.

10. **Puccinia Sonchi** Roberge. (Fig. 85.)

Rob., in Desm., *Ann. Sci. Nat.*, ser. iii, vol. ii, p. 74, 1849.

Gymnoconia Cirsii-lanceolati Bubak, *Konigl. Boehm. Gesfar. Wiss. Mathem-naturwiss Classe*, p. 10, 1899.

0. Spermogones amphigenous, scattered, sparse, associated with the uredosori.

II. Uredosori amphigenous and caulicolous, scattered, or more commonly in small orbicular or elliptical groups of 3 5 sori, 1–3 mm. long, seated on discoloured spots, orbicular, 0·25–1 mm. diam., on stems elliptical, confluent, and up to 5 mm. long, bullate, immersed, partly covered by the epidermis, yellow, opening by an irregular apical pore, encircled by a single layer of thick-walled chestnut-brown paraphyses. Spores elliptical or obovate, 30–42 × 20–24 mmm. ; epispore hyaline, densely and finely verrucose, 3–4 mmm. thick, cell-contents yellowish, oily ; germ-pores indistinct.

III. Teleutosori hypophyllous, scattered or confluent, seated on discoloured spots, bullate, dark chestnut-brown, orbicular or irregular, up to 2 mm. diam., compact, long covered by the epidermis ; encircled by a single layer of chestnut-brown clavate paraphyses. Spores elliptical or subclavate, 50–60 × 24–31 mmm. ; apex rounded or bluntly acuminate, thickened up to 6 mmm., base attenuate, frequently rounded, lower cell slightly narrower ; not or slightly constricted at the septum ; epispore smooth, pallid chestnut-brown, 1·5–2 mmm. thick, cell-contents granular ; pedicel persistent, tinted brown, up to 38 × 8 mmm. ; germ-pore of the upper cell apical or slightly oblique, conspicuous, basal pore immediately beneath the septum, conspicuous.

X. Mesospores not uncommon, subclavate or obovate, up to 53 mmm. long.

Host : *Sonchus oleraceus* L. On leaves and stems. Herb. No 281. II. III. Palmerston North (Wellington), 300 m., *G. H. C.* 14 June, 1919.

Distribution : Western Europe ; Algeria ; Canaries ; Japan ; Ceylon.

The host is introduced.

Grove (1913, p. 156) states that the paraphyses of the uredosori are in reality the upper part of an imperfect peridium ; at the top these cells become elongated and parallel, they are at first hyaline, but finally become dark brown and irregular in shape. This peculiar feature, and the immersed character, has led systematists to confuse it with an aecidium, but, as the uredospores are borne singly on pedicels, no such confusion should arise. In the specimens at hand a few teleutospores are present in the uredosori.

LATIN DIAGNOSES.

1. **Puccinia Foyana** sp. nov. (Fig. 78.) Ranunculaceae.

0. Incognitis.

I. Aecidiis amphigeniis, praecipue hypophyllis, in catervis irregularibus congestis, ad 10 mm. latis, luteis. Peridiis cupulatis, 0·5 mm. latis, marginibus erectis, aliquantum incurvis, albis, laciniatis. Aecidiosporis polygoniis vel ellipticis, 22–30 × 15–20 mmm. ; episporio hyalino, dense minuteque verrucoso, 1 mmm. crasso, contentu vacuolato, luteo.

III. Soris teleutosporiferis amphigeniis, petiolicoliis, et caulicolis, in catervis congestis, ad 5 mm. latis, bullatis, pulverulentibus, rotundis, ad 0·25–0·5 mm. latis, diu tectis ad extremum expositis rupta epidermide. Teleutosporis ellipticis, raro obovatis, 42–65 × 22–26 mmm.; apice acuminato, raro rotundato, papillato, leniter (6 mmm.) vel non incrassato, basi rotundato, non saepe attenuato, leniter ad septum constricto, episporio leve, castaneo, 2·5–3 mmm. crasso, contentu granuloso; pedicello deciduo, hyalino, ad 30 × 8 mmm.; foramine germinis cellulae superioris apicale, conspicuo, foramine basali etatim infra septum, conspicuo, saepe papillato.

X. Mesosporis vulgaribus, ellipticis, 20–35 × 17–24 mmm.

Habitat: In foliis vivis, petiolibusque et caulisque *Ranunculi Enysii* T. Kirk. Cass, Canterbury, New Zealand. *N. R. Foy.*

2. Puccinia namua sp. nov. (Fig. 79.) Umbelliferae.

0. Incognitis.

I. Aecidiis amphigeniis et caulicolis, in catervis congestis, ad 25 mm. longis, in maculis decoloratis inflatis, luteis. Peridiis cupulatis, 0·25 mm. latis, 1 mm. exstitis, marginibus erectis, non revolutis, laciniatis, albis. Aecidiosporis polygoniis vel subglobosis, 18–24 mmm. latis; episporio pallido-flavo, dense minuteque verrucoso, 1–1·5 mmm. crasso, contentu vacuolato, luteo.

II. Uredosoris amphigeniis, praecipue hypophyllis, et caulicolis, in foliis raris, rotundis, ad 1·5 mm. latis, in maculis pallido-flavis, in caulibusque ellipticis, ad 3 mm. longis, raro confluentibus, luteis, bullatis, pulverulentibus, rupta epidermide cinctis et partim tectis. Uredosporis ellipticis, obovatis, raro globosis, 18–30 × 16–22 mmm.; episporio pallido-flavo, raro et leniter echinulato, 1–1·5 mmm. crasso, contentu granuloso, luteo.

III. Soris teleutosporiferis uredosoris immixis et similibus, castancis. Teleutosporis subclavatis vel ellipticis, 30–40 × 18–26 mmm.; apice rotundato, non incrassato, basi attenuato; ad septum leniter constricto; episporio rustice verrucoso, castaneo, 2–2·5 mmm. crasso, contentu granuloso; pedicello persistente, hyalino, delicato, ad 25 × 7 mmm.; foramine germinis cellulae superioris apicale, conspicuo, foramine basali $\frac{3}{4}$ infra septum, conspicuo.

Hab.: In foliis vivis et caulisque *Anisotominis filifoliae* (Hook. f.) Cockayne et Laing. Mount Isobel, Hanmer, Canterbury, New Zealand. *W. D. Reid.*

3. Puccinia whakatipu sp. nov. (Fig. 80.)

0, I. Incognitis.

II. Uredosoris amphigeniis, praecipue hypophyllis et caulicolis, ellipticis, ad 0·25–1 mm. longis, raris vel catervis, bullatis, pulverulentibus, cinnamomeis, diu tectis ad extremum expositis rupta epidermide. Uredosporis ellipticis, obovatis vel subglobosis, 22–35 × 18–25 mmm.; episporio pallido-cinnamomeo, raro rustice echinulato, 2 mmm. crasso, contentu granuloso, cinnamomeo; foraminibus germinis 4, circulis, obscuris.

III. Soris teleutosporiferis uredosoris similibus, castaneo-fuscis. Teleutosporis ellipticis vel subclavatis, 30–40 × 20–26 mmm.; apice rotundato, non incrassato, basi rotundato raro attenuato; ad septum leniter constrictis; episporio subtiliter verruculoso, castaneo, 1·5–2 mmm. crasso, contentu granuloso; pedicello persistente, hyalino, delicato, ad 30 × 6 mmm.;

foramine germinis cellulae superioris apicale, conspicuo, foramine basali ⅔ infra septum, obscuro.

Hab.: In foliis vivis *Anisotominis filifoliae* (Hook. f.) Cockayne et Laing. Table Bay, Wakatipu, Otago, New Zealand. *W. D. Reid.*

4. Puccinia Anisotominis sp. nov. (Fig. 81.)

0, I. Incognitis.

II. Uredosoris hypophyllis, in maculis catervis, ellipticis, ad 1–2 mm. latis, bullatis, pallido-ferruginiis, tectis. Uredosporis subglobosis, ellipticis vel obovatis, 24–40 × 18–22 mmm.; episporio hyalino, raro rusticeque echinulato, 1·5–2 mmm. crasso, contentu granuloso, fuscus, foraminibus germinis 4, circulis, obscuris.

III. Soris teleutosporiferis amphigenis, praecipuo hypophyllis, confertis, ellipticis ad 1–1·5 mm. longis, vel confluentibus, ad 3 mm. longis; bullatis, pulverulentibus, fusco-castaneis, diu tectis ad extremum expositis rupta epidermide. Teleutosporis elongato-clavatis, 40–60 × 17–22 mmm.; apice rustice acuminato, raro rotundatis ad 6 mmm. crasso, basi attenuato; ad septum constrictis; episporio leve, aureo-fusco, 2–2·5 mmm. crasso in cellulo superiore, 1–1·5 mmm. in cellulo inferiore, contentu granuloso; pedicello persistente, hyalino, delicato, ad 40 × 7 mmm.; foramine germinis cellulae superioris apicale, conspicuo, foramine basali etatim infra septum, obscuro.

Hab.: In foliis vivis *Anisotominis Haastii* (F. v. M.) Cockayne et Laing. Lake Harris track, Otago, New Zealand. *W. D. Reid.*

5. Puccinia Euphrasiana sp. nov. (Fig. 82.) Scrophulariaceae.

Uredo australis Diet. et Neg., *Engler Jahrb.*, vol. 27, p. 15, 1899.

0. Spermagoniis hypophyllis, immersis, sparsis, raris, aliquantum aecidiis immixis.

I. Aecidiis hypophyllis, in raris catervis ad 5 mm. latis, in maculis decolatis, luteo. Peridiis plano-globosis, vel irregularibus, ad 0·2 mm. latis, diu epidermide tectis, hyalinis. Aecidiosporis subglobosis, polygoniis vel ellipticis, 22–30 × 18–22 mmm.; episporio hyalino, dense minuteque verruculoso, 1·5 mmm. crasso, contentu vacuolato, luteo.

II. Uredosoris amphigeniis, praecipue hypophyllis, raris, rotundatis vel ellipticis, ad 0·5–1 mm. latis, bullatis, pulverulentibus, cinnamomeis, epidermide rupta cinctis. Uredosporis subglobosis vel ellipticis, 20–30 × 18–23 mmm.; episporio pallido-cinnamomeo, leniter et aliquantum minute echinulato, 1–1·5 mmm. crasso, contentu vacuolato, cinnamomeo; foraminibus germinis 2, circulis, conspicuis.

III. Soris teleutosporiferis amphigeniis, in raris catervis 3–4 soriis, in maculis decoloratis, bullatis, pulverulentibus, fusco-castaneis, rupta epidermide cinctis et partim tectis. Teleutosporis ellipticis vel subclavatis, 23–38 × 15–20 mmm.; apice rotundato, non incrassato, basi leniter attenuato vel rotundato; ad septum constrictis; episporio leve, castaneo, 1·5 mmm. crasso; pedicello persistente, hyalino, ad 50 × 8 mmm; foramine germinis cellulae superioris apicale, obscuro, foramine basali etatim infra septum, obscuro.

Hab.: In foliis vivis *Euphrasiae cuneatae* Forst. York Bay, Wellington, New Zealand. *E. H. Atkinson, G. H. C.*

6. **Puccinia Wahlenbergiae** sp. nov. (Fig. 84.) Campanulaceae.

0. Incognitis.

III. Soris teleutosporiferis hypophyllis, caulicolis et floricolis, in foliis rotundis, raris, ad 1 mm. latis, in caulibusque ellipticis, ad 1·5 mm. longis, compactis, pulvinatis, pallido-fuscis, nudis vel epidermide rupta cinctis. Teleutosporis fusiformis vel subclavatis, 35–50 × 12–19 mmm.; apice fortis acuminato, ad crasso 18 mmm., basi attenuato; ad septum leniter necne constrictis; episporio leve, hyalino, vel pallido-fusco, 1·5–2 mmm. crasso, contentu vacuolato, pallido-fusco; pedicello persistente, hyalino, crasso, ad 30 × 10 mmm.; foramine germinis cellulae superioris apicale, conspicuo, foramine basali etatim infra septum, obscuro.

Hab.: In foliis vivis et caulibusque *Wahlenbergia albomarginata* Hook. Tokaanu–Waiouru Road, Taupo, New Zealand. *E. H. Atkinson.*

7. **Puccinia Celmisiae** sp. nov. (Fig. 86.) Compositae.

0, I. Incognitis.

II. Uredosoris amphigeniis, in maculis discoloratis, rotundatis, raris, ad 1 mm. latis vel circinnatis ad 5 mm. latis, bullatis, pulverulentibus, luteis, in denso tomento folii profunde immersis. Uredosporis globosis vel obovatis, 25–40 × 23–30 mmm.; episporio hyalino, minute tenuiter echinulato, 2 mmm. crasso, contentu granuloso, luteo; foraminibus germinis raris, 6–8, obscuro.

III. Soris teleutosporiferis uredosoris similibus, castaneis. Teleutosporis late ellipticis, 50–62 × 30–36 mmm.; apice rotundato, non incrassato, basi rotundato vel attenuatis, ad septum necne leniter constricto; episporio leve, pallido-castaneo, 2–3 mmm. crasso, contentu granuloso; pedicello deciduo, hyalino, delicato, ad 30 × 10 mmm.; foramine germinis cellulae superioris apicale, obscuro, foramine basali etatim infra vel ½ infra septum, obscuro.

Hab.: In foliis vivis *Celmisiae coriaceae* (Forst. f.) Hook. f. et *Celmisiae Hookeri* Cockayne. Mount Isobel, Hanmer, Canterbury, New Zealand. *W. D. Reid.*

THE UREDINALES, OR RUST-FUNGI, OF NEW ZEALAND: PART 2.

1. Family MELAMPSORACEAE.
2. Family COLEOSPORIACEAE.
3. Family PUCCINIACEAE (*continuatio*), Tribe PHRAGMIDEAE.
4. Family UREDINALES IMPERFECTI.
5. APPENDIX: Fungi parasitic upon the Uredinales.

The present paper is a continuation of Part 1, published in the *Transactions of the New Zealand Institute*, vol. 54, pp. 619–704, and deals with the remaining species of the New Zealand Uredinales at present in the herbarium (Cryptogams) of the Biological Laboratory. In this paper thirty-five species are dealt with, these belonging to three families and seven genera; but the greater number are but form-species included under the form-genera *Aecidium* and *Uredo*. This by no means completes the record of the New Zealand Uredinales, as fresh collections, often containing undescribed species, are constantly being sent in to the Laboratory. Doubtless within a few years the number of species will be doubled. The life-history of

members of each family differs somewhat from that of *Puccinia* as given in Part 1, p. 620; the differences are discussed under the descriptions of the families concerned.

Again I wish to record thanks to the following: W. D. Reid, E. H. Atkinson, and E. Bruce Levy, of the Biological Laboratory, for contributions of specimens; Dr. W. B. Grove (University of Birmingham), Dr. J. R. Weir (Bureau of Mycological Exchange, Washington), and Mrs. F. W. Patterson (late of the Bureau of Mycological Exchange, Washington), for contributions of specimens for comparative purposes; Dr. E. J. Butler (Director, Bureau of Mycology, Kew) and Mr. E. W. Mason (of the Imperial Bureau), for assistance regarding literature and references; Mr. C. C. Brittlebank (Department of Agriculture, Melbourne), for material for comparative purposes, loan of many type specimens, and for literature references; and Mr. J. G. Myers, for the revision of all Latin diagnoses.

The following publications have proved very useful, particularly in giving the geographical range of species, genera, and families; I have drawn freely from the synonymy cited in these works, this having been made necessary owing to the scarcity in New Zealand of most of the earlier literature: *The British Rust Fungi* (W. B. Grove); *North American Flora*, vol. 7 (J. C. Arthur); *The Rusts of Australia* (D. McAlpine); *Sylloge Fungorum* (P. A. Saccardo); *Thesaurus* (Lindau and Sydow); *Manual of the New Zealand Flora* (T. F. Cheeseman).

All drawings were made with the aid of a camera lucida, from spores mounted in 50 per cent. lactic acid - water solution. Drawings are all to the same scale, unless otherwise specified, and have all been reduced the same amount. Surface-sculpturings have been studied from material mounted dry, as in many instances the markings are not visible when spores are mounted in the usual solutions. It is frequently difficult to determine the number and position of the germ-pores, owing to the contents rendering the cell opaque. Generally, boiling for a second or so in lactic acid is all that is necessary to render the pores visible; frequently, however, it is necessary to treat the spores specially with certain stains (*e.g.*, Bismarck brown, eosin, or many other of the anilins will suffice), but in certain refractory cases no treatment will render the pores visible, when they are, in this paper, given as being "indistinct."

III. PUCCINIACEAE (*continuatio*).

Teleutosori compacted or pulverulent, naked or covered by the epidermis. Teleutospores one- to many-celled, free, borne on distinct pedicels; epispore coloured or hyaline, smooth, or variously sculptured, with one or more germ-pores in each cell. Basidia external.

Tribe PHRAGMIDEAE.

Teleutospores in pulvinate, dark-coloured sori .. .. .. 5. *Phragmidium.*
Teleutospores in yellow fibrils .. .. 6. *Hamaspora.*

5. PHRAGMIDIUM Link.

Link., *Ges. Nat. Freunde Berlin Mag.*, vol. 7, p. 30, 1815.

Hypodermium Link., *l.c.*, p. 26. *Aregma* Fr., *Obs. Myc.*, vol. 1, p. 225, 1815. *Epitea* Fr., *Syst. Myc.*, vol. 3, p. 510, 1832. *Lecythea* Lev., *Ann. Sci. Nat.*, ser. iii, vol. 8, p. 373, 1847. *Earlea* Arth., *Res. Sci. Congr. Bot. Vienne*, p. 341, 1906.

Autoecious. Cycle of development includes 0, I, II, III.

0. Spermogones conical or flattened, subcuticular, without ostiolar filaments.

I. Caeomata indefinite, erumpent, without peridia but usually encircled by paraphyses. Caematospores catenulate, usually subglobose, epispore hyaline or tinted yellow, verrucose; germ-pores scattered, numerous, obscure.

II. Uredosori without peridia, usually encircled by paraphyses, erumpent, pulverulent. Uredospores globose or elliptical, borne singly on pedicels; epispore verrucose or echinulate, coloured or hyaline; germ-pores scattered, numerous, obscure.

III. Teleutosori erumpent, definite, with or without paraphyses, soon naked, almost black. Teleutospores divided by transverse septa into 2 or several cells; wall laminate, the middle layer dark-coloured and rigid, usually coarsely warted, sometimes smooth; germ-pores 2 to several in each cell, laterally placed, conspicuous; pedicels prominent, persistent, hyaline, often roughened and much swollen below. Basidiospores subglobose, smooth.

This genus is confined to the host family Rosaceae.

Distribution: Europe; Asia; North and South America; Ceylon; Australia.

Of the five New Zealand species, three are endemic, one is indigenous, and one introduced.

On germination a basidium is produced from each cell of the teleutospore; this becomes four-celled, and from each cell arises a sterigma, bearing on its apex the subglobose basidiospore.

Phragmidium is a well-defined genus, and is characterized by the large, many-celled, dark-coloured teleutospores; the wall of the spore is thick, usually opaque, and distinctly laminated. This feature may readily be seen if the spores are boiled for a second or two in lactic-acid solution, for the epispore becomes much swollen and may be seen as a hyaline envelope surrounding the spore, often swelling to a thickness of 10 mmm. or more.

The apex is usually crowned with a conspicuous hyaline or coloured papilla, but in certain species this may be wanting. The pedicels often attain a length several times that of the spore; they are hyaline, persistent, stout, and frequently the lower part is swollen, the central area of this swollen portion being often stuffed with an oily coloured matrix, a feature seen as a rule only in fresh material.

The caeomata greatly resemble the uredosori, and are sometimes difficult to separate on account of this similarity, but the catenulate spores characterize them.

KEY TO THE SPECIES OF PHRAGMIDIUM.

Host belonging to the family Rosaceae.
- Host belonging to the tribe Roseae .. .. 1. *Phr. mucronatum.*
- Host belonging to the tribe Potentilleae.
  - Teleutospores 1–6-celled, commonly 4–5 .. 4. *Phr. Potentillae.*
  - Teleutospores 4–7-celled, commonly 6.
    - Teleutospores long-cylindrical .. .. 2. *Phr. Acaenae.*
    - Teleutospores oblong-terete .. .. 5. *Phr. subsimile.*
  - Teleutospores 5–8-celled, commonly 7–8 .. .. 3. *Phr. novae-zelandiae.*

1. **Phragmidium mucronatum** Schlechtendal. (Fig. 88.) Rosaceae.

Schlecht. *Fl. Berol.*, vol. 2, p. 156, 1824.

Uredo Rosae-centrifoliae Pers., *Syn. Fung.*, p. 215, 1801. *U. miniata* Pers., *l.c.*, p. 216. *U. elevata* Schum., *Enum. Pl. Saell.*, vol. 2, p. 229, 1803. *U. Rosae* Schum., *l.c.*, p. 230. *Puccinia Rosae* Schum., *l.c.*, p. 235. *Aecidium Rosae* Roehling, *Deuts. Fl.*, 2nd ed., vol. 3, p. 122, 1813. *Aregma mucronata* Fr., *Obs. Myc.*, vol. 1, p. 225, 1815. *Uredo Eglanteriae* H. Mart., *Fl. Mosq.*, 2nd ed., p. 230, 1817. *Caeoma miniatum* Schlecht., *Fl. Berol.*, vol. 2, p. 120, 1824. *C. Rosae* Schlecht., *l.c.* *Phr. oblongum* Bon., *Coniom.*, p. 60, 1860. *Phr. Rosarum* Fcl., *Symb. Myc.*, p. 47, 1869. *Phr. subcorticinum* Wint., in *Rabh. Krypt. Fl.*, vol. 1, p. 228, 1881. *Phr. disciflorum* James, *Contr. U.S. Nat. Herb.*, vol. 3, p. 276, 1895. *Aregma disciflora* Arth., *Proc. Ind. Acad. Sci.*, 1898, p. 179, 1899. *Phragmidium Rosae-pimpinellifoliae* Diet., *Hedw.*, vol. 44, p. 339, 1905.

0. Spermogones caulicolous, sparse, flattened, immersed, honey-coloured.

I. Caeomata hypophyllous, caulicolous, petiolicolous and fructicolous, on leaves scattered or crowded, orbicular, pulvinate, 0·25–1 mm. diam., on stems confluent, up to 20 mm. long, forming large inflated distortions; reddish-orange, pulverulent; paraphyses present and as a rule encircling only the smaller sori; incurved, clavate, hyaline. Spores elliptical, obovate, or subglobose, 22–30 × 15–23 mmm.; epispore hyaline, finely and densely verruculose, 2–2·5 mmm. thick, cell-contents oily, reddish-orange.

II. Uredosori hypophyllous, scattered, seated on pallid-yellow spots, orbicular, 0·25–0·5 mm. diam., orange, pulverulent; encircled by a layer of incurved hyaline, clavate paraphyses. Spores elliptical, obovate, or subglobose, 22–28 × 15–20 mmm.; epispore hyaline, closely, finely and bluntly echinulate, 2 mmm. thick, cell-contents pallid-orange; germ-pores scattered, numerous (6–8), obscure.

III. Teleutosori hypophyllous, scattered, orbicular, 0·25–0·5 mm. diam., somewhat pulverulent, black, naked, with numerous spores in each sorus. Spores 5–9-celled, commonly 7–8, oblong-terete, 72–98 × 28–35 mmm.; apex obtusely rounded, not thickened, crowned with a prominent papilla, hyaline at the tip, coloured below, not continuous with the upper cell-wall, up to 12 mmm. long, base rounded or truncate, spore narrowed slightly above and below; not constricted at the septa; wall dark chestnut-brown, opaque, 5–7 mmm. thick, unevenly covered with coarse hyaline warts which are more numerous apically; pedicel persistent, continuous with the spore, tinted above, hyaline below, hollow, up to 150 mmm. long, 8–10 mmm. thick, slightly (15 mmm.) swollen at the base, lower third minutely and closely verruculose, central area filled with an oily orange-coloured matrix; germ-pores 3–5 in each cell, commonly 3, conspicuous.

Hosts :—

Rosa Eglentaria Mill. (= *R. rubiginosa* L.). On leaves, stems, petioles, and fruits. Herb. No. 373. I. York Bay (Wellington), *E. H. Atkinson!* 3 April, 1921. Blenheim, *E. H. Atkinson!* 3 Nov., 1922. Mapua (Nelson), *G. H. C.* 17 May, 1922.

Rosa sp. cult. II, III. Nelson, *W. C. Hyde!* 7 Jan., 1922.

Distribution: Europe; western Asia; North and South America; Hawaii; Ceylon; Australia.

Both hosts are introduced, the former being common throughout. The caeomata form conspicuous reddish-orange inflated areas on the stems of sweetbrier. The mycelium of this stage is perennial in the host-tissues, so that once the plant has become infected the rust appears on it season

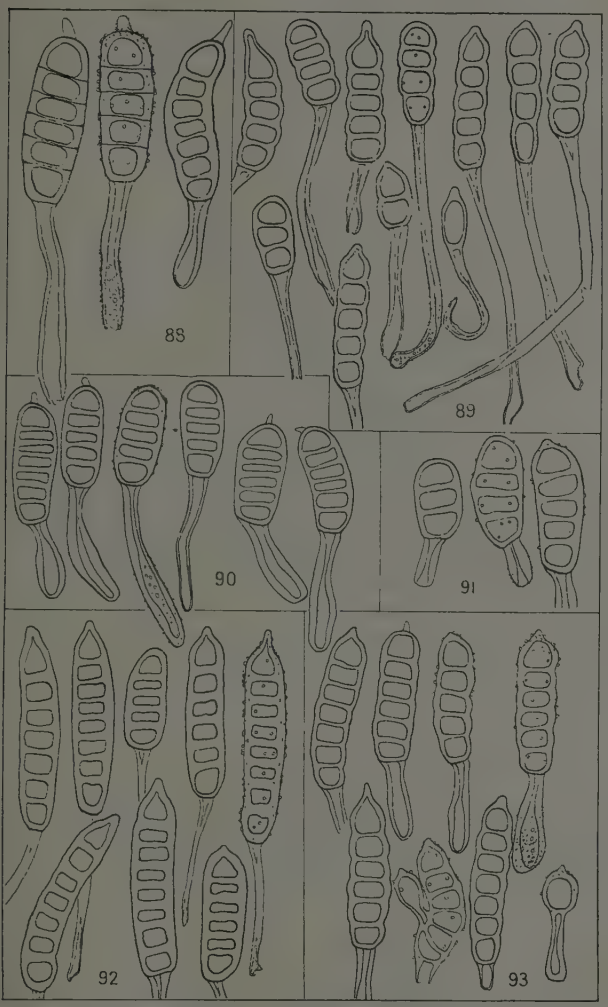

FIG. 88.—*Phragmidium mucronatum* Schlecht. Teleutospores from *Rosa* sp. cult.
FIG. 89.—*Phragmidium Potentillae* P. Karst. Teleutospores from *Acaena Sanguisorbae* Vahl.
FIG. 90.—*Phragmidium subsimile* G. H. Cunn. Teleutospores from *Acaena Sanguisorbae* Vahl. var. *pilosa* T. Kirk.
FIG. 91.—*Phragmidium Sanguisorbae* Schroet. Teleutospores from *Poterium Sanguisorba*. Material collected by Dr. Grove, Boxhill, London, 29th August, 1920.
FIG. 92.—*Phragmidium novae-zelandiae* G. H. Cunn. Teleutospores from *Acaena novae-zelandiae* T. Kirk.
FIG. 93.—*Phragmidium Acaenae* G. H. Cunn. Teleutospores from *Acaena microphylla* Hook. f.

All × 300.

after season. Spores so produced cause local infection of the leaves, and these sori in turn give rise to uredo- and teleuto-spores.

This rust is prevalent throughout the Nelson and Marlborough districts, and in the spring becomes conspicuous on account of the brilliant colour of the caeomatospores.

Ramsbottom (1913) has shown that the name of this species should be as above.

2. **Phragmidium Acaenae** n. sp.* (Text-fig. 93, and Plate 1, fig. 1.)

0. Spermogones amphigenous, sparse, scattered, conical, pallid yellow.

I. Caeomata hypophyllous, scattered, orbicular when 0·5–1 mm. diam., or elliptical and up to 3 mm. long, pulvinate, pulverulent, orange; encircled by a dense layer of hyaline, incurved, clavate, persistent paraphyses, overtopping the spores. Spores globose, obovate, or less commonly elliptical, 18–28 × 16–20 mmm.; epispore hyaline, closely and finely verruculose, 1–1·5 mmm. thick, cell-contents orange, vacuolate.

III. Teleutosori hypophyllous and petiolicolous, sparse, scattered, orbicular, 0·1–0·5 mm. diam., at first compact and pulvinate, becoming pulverulent, shining-black, naked, with few spores in each sorus. Spores 4–7-celled, commonly 6, long-cylindrical, 50–95 × 20–25 mmm.; apex bluntly acuminate or rounded, slightly or not thickened, often crowned with a prominent hyaline papilla, up to 10 mmm. long, not continuous with the upper cell-wall, base rounded, spore slightly or not narrowed above and below; not or slightly constricted at the septa; wall light chestnut-brown, 3–4 mm. thick, sparsely covered with a few coarse hyaline warts which are more numerous apically or may be almost absent; pedicel persistent, continuous with the spore, tinted above, hyaline below, hollow, up to 50 mmm. long, commonly much less, 5–9 mmm. thick, swollen at the base to 20 mmm., lower third closely verruculose, germ-pores 2–3 in each cell, conspicuous.

Host: *Acaena microphylla* Hook. f. On leaves and petioles. Herb. No. 307. I, III. Botanical Gardens, Gore (Southland), *E. B. Levy!* 1 Feb., 1921. (Type.)

The host is endemic, and is not uncommon throughout the mountain districts. (Cheeseman, 1906, p. 132.)

This species closely resembles *Phr. subsimile*, but differs in the long-cylindrical shape of the teleutospores, their verrucose apex, much shorter pedicels, and in the cells not being discoid.

3. **Phragmidium novae-zelandiae** n. sp. (Text-fig. 92, and Plate 1, fig. 2.)

0. Spermogones similar to *Phr. Acaenae.*

I. Caeomata similar to *Phr. Acaenae.*

III. Teleutosori hypophyllous, sparse, elliptical, up to 3 mm. long, pulvinate, pulverulent, the spores becoming agglutinated into compact masses, dull greyish-black, naked, with very many spores in each sorus. Spores 4–8-celled, commonly 6–7, oblong-cylindrical, 65–118 × 18–24 mmm.; apex acuminate, seldom rounded, not or slightly thickened, drawn into a long papilla, continuous with the upper cell-wall, tinted, hyaline at the

* Latin diagnoses of new species will be found on pages 51–55.

tip, up to 8 mmm. long, base rounded or slightly attenuate, spore slightly narrowed above and below; not constricted at the septa; wall sepia-coloured, 4–6 mmm. thick, coarsely and densely warted, warts hyaline and more numerous apically; pedicel persistent, continuous with the spore, hyaline below, tinted above, up to 100 mmm. long, 4–6 mmm. thick, not or slightly inflated basally, lower half minutely and densely verruculose, germ-pores 2–4 in each cell, conspicuous.

Host: *Acaena novae-zelandiae* T. Kirk. On leaves. Herb. No. 766. I–III. Seashore, Seatoun (Wellington), *E. H. Atkinson!* *G. H. C.* 27 Jan., 1921. Queenstown (Otago), 400 m., *W. D. Reid!* 18 Dec., 1921. (Type.)

The host is endemic and is not uncommon throughout. (Cheeseman, 1906, p. 131.)

This rust is characterized by the large size of the teleutospores, large number of cells, dark and thick wall, and acuminate apex. The pedicels are more slender than in our other species, and are not swollen at the base. The large number of teleutospores in the sorus, and the manner in which they are compacted together, serve to separate this from any other species that may be present on the same plant.

4. **Phragmidium Potentillae** P. Karsten. (Text-fig. 89, and Plate 1, fig. 3.)

Karst., *Bidr. Finl. Nat. Folk*, vol. 31, p. 49, 1879.

Puccinia Potentillae Pers., *Syn. Fung.*, p. 229, 1801. *Uredo Potentillae* Schum., *Enum. Pl. Saell.*, vol. 2, p. 228, 1803. *Phragmidium obtusatum* Schmidt and Kunze, *Deuts. Schwamme*, vol. 5, p. 5, 1816. *Caeoma Potentillae* Schlecht., *Fl. Berol.*, vol. 2, p. 121, 1824.

0. Spermogones amphigenous, in small scattered groups, pallid yellow.

I. Caeomata amphigenous, solitary or crowded, often confluent, elliptical, less commonly orbicular, 0·5–1·5 mm. long, pulverulent, orange; encircled by a dense layer of cylindrical, hyaline, incurved paraphyses. Spores subglobose or elliptical, 20–26 × 15–22 mmm.; epispore hyaline, finely and closely verrucose, 1·5–2 mmm. thick, cell-contents orange.

II. Uredosori hypophyllous, scattered, orbicular, 0·5–2 mm. diam., pulverulent, orange, encircled by a layer of cylindrical or clavate hyaline, incurved paraphyses. Spores subglobose or obovate, 18–26 × 15–20 mmm.; epispore hyaline, finely and closely echinulate, 1·5 mmm. thick, cell-contents orange; germ-pores scattered, numerous, obscure.

III. Teleutosori amphigenous, chiefly hypophyllous, scattered or confluent, orbicular, 0·25–3 mm. diam., pulvinate, compact, shining-black, naked, with numerous spores in each sorus. Spores 1–5-celled, commonly 4, cylindrical, 55–95 × 18–25 mmm.; apex acuminate or rounded, not thickened nor papillate, base rounded; constricted at the septa; wall golden-brown, smooth, 2–4 mmm. thick; pedicel persistent, continuous with the spore, very long, up to 200 mmm. by 4–7 mmm. thick, hyaline, hollow, not or slightly swollen at the base, lower third closely and finely verruculose; germ-pores 2–3 in each cell, conspicuous.

Hosts:—

Acaena Sanguisorbae Vahl. On leaves. Herb. Nos. 75, 765, 770. I. Karori (Wellington), 100 m., *G. H. C.* 5 Mar., 1920. III. Routeburn Valley (Otago), 500 m, *W. D. Reid!* 8 May, 1921. II, III. Table Bay, Wakatipu (Otago), 850 m., *W. D. Reid!* 23 May, 1922.

Acaena novae-zelandiae var. *pallida* T. Kirk. Herb. No. 296. II. Seashore, Seatoun (Wellington), *E. H. Atkinson!* *G. H. C.* 27 Jan., 1921.

Acaena ovina A. Cunn. Herb. No. 296. II. Seashore, Seatoun (Wellington), *E. H. Atkinson!* *G. H. C.* 27 Jan., 1921.

Distribution: Europe; Asia Minor; Siberia; Japan; North America; Australia.

Two of the hosts are indigenous, *A. novae-zelandiae* var. *pallida* being endemic; *A. ovina* has been introduced from Australia. (Cheeseman, 1906, p. 131, 1073.)

The New Zealand form does not agree in all particulars with the European, differing mainly in the acuminate apex of the teleutospore. The cylindrical shape of the teleutospore, smooth, light-coloured wall, constrictions at the septa, and very long slender pedicels, separate this from other species found in New Zealand on *Acaena*. Specimens vary somewhat in the degree of roundness or otherwise of the apex, as well as in the length of the pedicels, for in certain sori the spores may all be rounded at the apex, and in others they all may be acuminate; the pedicels may average 100 mmm. in length, or may be twice this length. Generally, the larger the sorus the longer the pedicels.

Teleutospores are abundant in New Zealand, and in some collections literally cover the leaves of the host. As they may frequently be found on the same plant with *Phr. subsimile*, and occasionally even on the same leaf, the following method of separating the two on sorus characters may prove useful:—

Teleutosori compact, shining-black, usually small	.. *Phr. Potentillae.*
Teleutosori pulverulent, greyish-black, usually large	.. *Phr. subsimile.*

It is difficult to separate caeomata from uredosori, as they generally closely resemble one another; frequently sections are necessary to determine the difference. In this species, however, the uredosori are generally surrounded by the ruptured epidermis, which persists for a considerable time; this feature is generally absent from the caeomata, or, if not absent, is invariably less noticeable.

5. **Phragmidium subsimile** n. sp. (Fig. 90.)

0. Spermogones hypophyllous, sparse, scattered, pallid yellow.

I. Caeomata hypophyllous, sparse, scattered, orbicular, 0·5–3 mm. diam., pulverulent, orange; encircled by a dense layer of hyaline, clavate, incurved, persistent paraphyses. Spores subglobose, 18–22 mmm.; epispore hyaline, densely and closely verrucose, 1·5–2 mmm. thick, cell-contents vacuolate, orange.

III. Teleutosori hypophyllous, scattered, elliptical, up to 2 mm. long, pulverulent, greyish-black, containing very many spores in each sorus. Spores 5–7-celled, commonly 6, oblong-terete, 57–70 × 22–30 mmm.; apex rounded, not thickened, often crowned with a prominent, tinted, smooth papilla, not continuous with the upper cell-wall, up to 10 mmm. long, base rounded, spore markedly narrowed above and below; not constricted at the septa; wall chestnut-brown, 3–5 mmm. thick, sparsely and coarsely warted, warts hyaline, unequally distributed; pedicel persistent, continuous with the spore, tinted above, hyaline below, stout, up to 100 mmm. long, 6–10 mmm. thick, hollow, swollen to 18 mmm. at base, lower half closely and minutely verruculose; germ-pores 2–3 in each cell, obscure.

Hosts :—

Acaena Sanguisorbae Vahl. var. *pilosa* T. Kirk. On leaves. Herb. Nos. 443, 767, 768. I, III. Macraes (Otago) 600 m., *W. D. Reid!* 28 Nov., 1921. Queenstown (Otago), 650 m., *W. D. Reid!* 18 Dec., 1921. (Type.)

Acaena Sanguisorbae Vahl. Herb. No. 769. I, III. Table Bay, Wakatipu (Otago), 850 m., *W. D. Reid!* 23 May, 1922.

The host species *A. Sanguisorbae* is indigenous and widespread; it occurs also in Australia, Tasmania, and Tristan d'Acunha; the variety *pilosa* is endemic, and is not uncommon. (Cheeseman, 1906, p. 131.)

This species somewhat resembles *Phr. Sanguisorbae* Schroet. (fig. 91), but differs in the differently-shaped, broader teleutospores, in there being 5–7 cells in the spore instead of 2–5, and in the much longer pedicels. The teleutosorus characters, too, are quite different.

This species serves as a connecting-link between *Phr. Acaenae* and *Phr. Sanguisorbae;* and, of the New Zealand species, one would imagine the ancestral form to have been of the *Phr. Sanguisorbae* type, from which arose in succession *Phr. subsimile*, *Phr. Acaenae*, and finally *Phr. novae-zelandiae*. *Phr. Potentillae*, on the other hand, would appear to have arisen from a different form, as it has not the same general resemblance to the three species discussed above. Dr. Cockayne informs me that the hosts readily hybridize, and that the so-called species *A. Sanguisorbae* is in reality a composite species. This would partly account for the fact that on this species as many as three species of *Phragmidium* occur, whereas on other well-defined host species, and even varieties, one rust only is found.

I am indebted to Dr. Grove for specimens of *Phr. Sanguisorbae*, from which fig. 91 has been drawn.

6. HAMASPORA Koernicke.

Koern., *Hedw.*, vol. 16, p. 23, 1877.

Autoecious. Cycle of development includes 0, II, III.

0. Spermogones scattered, flattened-globose, subcuticular, associated with the uredosori.

II. Uredosori without peridia, definite, erumpent, encircled by a dense layer of hyaline incurved paraphyses. Uredospores borne singly on pedicels, globose or obovate; epispore hyaline, thick, verruculose; germ-pores scattered, numerous, obscure.

III. Teleutosori erumpent, definite, paraphysate, orange. Teleutospores aggregated into conspicuous fibrillose filaments, consisting of spores and pedicels closely interwoven; 4–6-celled by transverse septa; wall not distinctly laminate, hyaline, smooth, with one indistinct germ-pore in each cell; pedicels several times the length of the spore, hyaline; basidiospores obovate or reniform, smooth.

Distribution: Africa; Philippines; Java; Australia.

The single New Zealand species is indigenous and widespread. The genus is confined to *Rubus*, a genus of the family Rosaceae.

Hamaspora consists of two species—*H. longissima* (Theum.) Koern., found in South Africa on *Rubus rigida*, and *H. acutissima* Syd., occurring on *Rubus Rolfei* in the Philippines, and on *R. moluccanus* L. in Java and Queensland.

In the past confusion has arisen as to the systematic position of this species, and many systematists have placed it under *Phragmidium*, but

that it is not a *Phragmidium* becomes obvious when the following facts are considered :—

(*a.*) Sorus characters : The teleutospores are early aggregated into fibrillose filaments ; in mass they are pallid yellow (cream or white with age), not dark coloured.

(*b.*) The uredosori are accompanied by the spermogones, caeomata being absent.

(*c.*) The shape of the teleutospore does not resemble any species of *Phragmidium*, although approaching certain species of *Gymnosporangium.*

(*d.*) The hyaline non-laminate wall of the teleutospore differs from any species of *Phragmidium*, but approaches *Gymnosporangium.*

(*e.*) The presence of a solitary germ-pore in each cell is a character not present in any *Phragmidium*, and occurs in only a few species of *Gymnosporangium.* Moreover, with these two genera the pores are usually conspicuous, whereas with *Hamaspora* the pores are visible only at germination.

(*f.*) The method of germination differs slightly from *Phragmidium*, but considerably from that of *Gymnosporangium.*

(*g.*) The pedicels are of an extraordinary length, and taper gradually to a fine point.

From a consideration of these facts it would appear that, morphologically, the teleutospores more closely resemble *Gymnosporangium* than they do *Phragmidium*, and that in behaviour towards their hosts (*e.g.*, being autoecious instead of heteroecious) and in the method of germination they more closely approach *Phragmidium.*

1. **Hamaspora acutissima** Sydow. (Text-figs. 94, 95, and Plate 1, fig. 4.)
Rosaceae.
Syd., *Mon. Ured.*, vol. 3, p. 80, 1912.

0. Spermogones immersed, hypophyllous, associated with the uredosori.

II. Uredosori hypophyllous, scattered, orbicular, 0·25–0·5 mm. diam., golden-yellow ; surrounded by and mixed with numerous incurved hyaline cylindrical paraphyses. Spores globose, obovate, or shortly elliptical, 20–25 × 17–19 mmm. ; epispore hyaline, finely and densely verruculose, 2 mmm. thick, thickened at the apex to 3·5 mmm., cell-contents pallid yellow ; germ-pores scattered, 6–8, obscure.

III. Teleutosori hypophyllous, scattered or crowded in irregular groups, seated on indefinite pallid spots which are visible on the upper surface, elliptical, 0·5–1 mm. diam., pulverulent, surrounded by the ruptured epidermis. Spores aggregated into pallid-yellow fibrils up to 20 mm. long, fading with age, 4–6-celled, long-cylindrical, 100–180 × 14–22 mmm. ; apex strongly acuminate, tapering to a fine sharp point, thickened up to 10 mmm., base truncate ; not constricted at the septa ; epispore hyaline, smooth, 1 mmm. thick, cell-contents orange, granular ; pedicel persistent, continuous with the spore, tapering basally to a fine point, up to 600 mmm. long, 10–15 mmm. thick immediately below the spore, hollow ; germ-pore solitary in each cell, indistinct.

Host : *Rubus australis* Forst. f. On leaves. Herb. Nos. 7, 594. III. Herekopere Islands, *T. Kirk !* 1882. Mount Waiopehu (Wellington), 1,000 m., *G. H. C.* 26 Oct., 1919. Otira Gorge (Canterbury), 500 m., *E. H. Atkinson !* 30 Jan., 1920. Peel Forest (Canterbury), 250 m.,

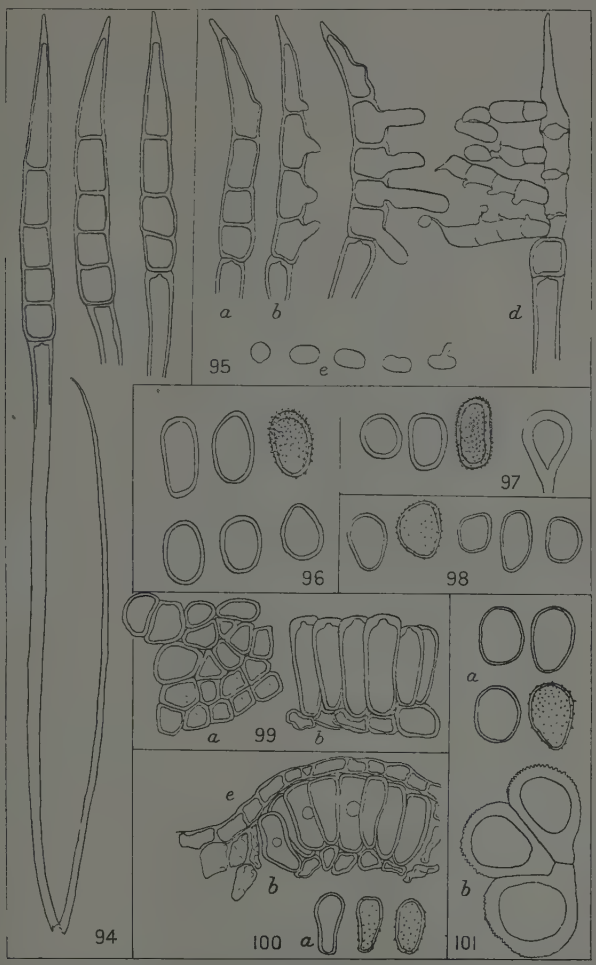

FIG. 94.—*Hamaspora acutissima* Syd. Teleutospores from *Rubus australis* Forst. f.

FIG. 95.—*Hamaspora acutissima* Syd. Teleutospores, showing different stages during germination; (*e*) basidiospores, one germinating.

FIG. 96.—*Coleosporium Fuchsiae* Cke. Uredospores from *Fuchsia excorticata* (Forst. f.) L. f.

FIG. 97.—*Melampsora Kusanoi* Diet. Uredospores and paraphysis from *Hypericum gramineum* Forst. f.

FIG. 98.—*Pucciniastrum pustulatum* Diet. Uredospores from *Epilobium pubens* A. Rich.

FIG. 99.—*Melampsora Lini* Desmaz. Teleutospores from *Linum monogynum* Forst. (*a*) Plan of same showing arrangement of the spores in a sorus; larger cells on the outside. Note germ-pores.

FIG. 100.—*Melampsoridium betulinum* Kleb. Uredo- and teleuto-spores from *Betula alba* L. (*a*) Uredospores; (*b*) teleutospores covered by epidermis (*e*). Note fusion nucleus in several of the cells.

FIG. 101.—*Milesina Histiopteridis* G. H. Cunn. Uredospores and peridial cells (*b*) from *Histiopteris incisa* (Thunb.) J. Sm.

Figs. 94 and 95 × 300; all others × 400.

H. H. Allan! Feb., 1920. Makarora (Otago), *W. D. Reid!* 25 Mar., 1921. Tokaanu–Waiouru Road, Taupo, 400 m., *E. H. Atkinson!* 11 Mar., 1922.

Distribution: Java; Queensland.

The host is endemic, and is common throughout. (Cheeseman, 1906, p. 125.) The teleutospore stage only has been collected in New Zealand; this is common, and is readily observed owing to the conspicuous nature of the spore-masses.

The description of the uredospores given above is drawn up from information kindly supplied by Mr. C. C. Brittlebank, Melbourne.

The spores and their pedicels are inextricably interwoven into filaments, so that it is difficult to separate out single spores for the purposes of measurement and drawing. These filaments are formed in the following manner: The sori are at first bullate and covered by the epidermis; this soon becomes ruptured, owing to the increasing pressure exerted by the developing spores, and the spores become exposed, when they are seen as a pulvinate mass standing above the leaf-surface about 0·5 mm. Spores are being produced from the same sorus during the whole of the summer months, and appear to be developed in batches. As each successive batch develops, the spores become forced between the pedicels of the preceding batch, which are consequently carried upward away from the base of the sorus. Gradually the filament becomes formed, and, as the spores and pedicels of successive batches are closely interwoven, the filament does not break up, but remains compact, and may persist for several seasons, especially if it happens to become entangled with the spines which cover the under-surface of the leaf. The filaments do not, as a rule, remain for any length of time attached to the sori, so that they may frequently be seen on the same leaf with the detached filaments. The empty sorus usually contains numerous incurved, cylindrical paraphyses. Germination occurs as soon as the spores mature, and, as spores of all ages usually occur in the same filament, different stages of development may readily be obtained. The first indication of germination is the appearance of a slight swelling on one side of a cell; this is followed by the gradual development of the basidium, which protrudes at this point. At first unicellular, the basidium soon becomes four-celled by the appearance of transverse septa. Shortly after the septa appear the sterigmata grow out, one from each cell of the basidium; on each a small, smooth-walled, colourless basidiospore appears. The basidia are allantoid, and may attain a size of 60 × 10 mmm.; the basidiospores are obovate or reniform, and usually 15 × 10 mmm.

Until 1912, when P. and H. Sydow (*l.c.*) separated the species described above, one species only was known. This was by Thuemen in 1875 (*Flora*, vol. 58, p. 379) described as *Phragmidium longissimum*. Two years later Koernicke (*l.c.*) placed it in *Hamaspora*, a genus he erected to contain it and another form with similar spores (now *Gymnosporangium Ellisii* Farl.). In 1888 De Toni (in Sacc., *Syll.*, vol. 7, p. 750) compiled it under *Phragmidium*. Massee in 1893 (*Grev.*, vol. 22, p. 17) considered that it was neither *Hamaspora* nor *Phragmidium*, but stated that he did not care to undertake the responsibility of forming a new genus (!). Dietel (1900, p. 73) considered that there were no grounds for separating it from *Phragmidium*, although he recognized a resemblance to *Gymnosporangium* in the teleutospore structure. McAlpine (1906, p. 187) in 1906 included it under *Phragmidium*, but mentioned the fact that it differed considerably from other species included in that genus.

II. COLEOSPORIACEAE.

Teleutosori waxy. Teleutospores compacted laterally into one (seldom two) waxy layer, sessile. Basidia internal. Uredosori, when present, naked (*Coleosporium*), or encircled by paraphyses (*Ochropsora*); uredospores catenulate (*Coleosporium*), or borne singly on pedicels (*Ochropsora*). Aecidia, when present, with a definite peridium; spores catenulate.

The contents of the teleutospores at maturity become divided into four cells by transverse septa; from each cell grows out a sterigma bearing the basidiospore. This internal basidium characterizes the family, which contains the following five genera, only one of which has been collected in New Zealand: (1) *Coleosporium* Lev.; (2) *Gallowaya* Arth.; (3) *Ochropsora* Diet.; (4) *Chrysopsora* Lagerh.; and (5) ? *Zaghouania* Pat. *Chrysopsora* is by Dietel (1900) included in the Pucciniaceae, but the internal basidium excludes it from this family. *Zaghouania* has the basidium formed internally, but prior to the formation of the basidiospores the basidium becomes external. On this account it has been placed in a separate family, the Zaghouaniaceae, by Dumee and Maire (*Bull. Soc. Myc. Fr.*, 1902). Grove (1913, p. 318) provisionally places it in the Coleosporiaceae.

1. COLEOSPORIUM (Leveille).

Lev., *Ann. Sci. Nat.* ser. 3, vol. 8, p. 373, 1847.

Peridermium Chev., *Fl. Env. Paris*, vol. 1, p. 385, 1826. *Erannium* Bon., *Coniom.*, p. 17, 1860. *Stichopsora* Diet., *Bot. Jahrb.*, vol. 27, p. 565, 1899.

Heteroecious. Cycle of development includes 0, I, II, III.

0. Spermogones flattened, linear, without ostiolar filaments, dehiscing by a logitudinal fissure.

I. Aecidia erumpent, definite. Peridia cylindrical, inflated, opening by an irregularly torn apical cleft, hyaline. Aecidiospores subglobose or elliptical; epispore hyaline, covered with densely-packed deciduous tubercules; germ-pores absent.

II. Uredosori without peridia, erumpent, definite, pulverulent. Uredospores catenulate, subglobose, elliptical, or obovate; epispore hyaline, verruculose, tubercules somewhat deciduous; germ-pores indistinct.

III. Teleutosori indehiscent, waxy, flattened, indefinite. Teleutospores at first unicellular, becoming 4-celled by transverse septa, sessile; epispore smooth, hyaline, strongly thickened at the apex; germ-pores indistinct.

Distribution: Europe; America; Asia; East Indies. The following endemic species occurs in New Zealand.

Aecidia, where known, occur on the needles of two-leaved species of *Pinus;* the other stages on several families of dicotyledons. In *Gallowaya*, on the other hand, the teleutospores (the only stage known) occur on *Pinus*, and on account of this fact, and because only teleutospores are known in the cycle, Arthur (1906, p. 336) placed it in a separate genus.

1. Coleosporium Fuchsiae Cooke. (Text-fig. 96, and Plate 2, fig. 9.)

Onagraceae.

Cke., *Grev.*, vol. 14, p. 129, 1886.

0, I. Unknown.

II. Uredosori amphigenous, seated on small angular yellow spots, orbicular, 0·5–1 mm. diam., orange-yellow, pulverulent, pulvinate, surrounded by the ruptured epidermis. Spores elliptical, obovate, or subglobose, 20–31 × 14–18 mmm; epispore hyaline, closely, coarsely and unequally

echinulate, spines sparsely distributed towards base of spore, 1·5 mmm. thick, cell-contents granular, orange ; germ-pores indistinct.

III. Unknown.

Host : *Fuchsia excorticata* (Forst. f.) L. f. On leaves. Herb. Nos. 190, 620. II. Hawyard's, Upper Hutt (Wellington), *T. Kirk !* 3 Sept., 1881. (Type collection.) Weraroa (Wellington), *G. H. C.* 6 Oct., 1919. (On seedlings.) York Bay (Wellington), *E. H. Atkinson !* 24 Oct., 1920. Palmerston North (Wellington), *R. Waters !* 27 Jan., 1921. Seashore, Seatoun (Wellington), *E. H. Atkinson ! G. H. C.* 24 March, 1922. Oamaru (Otago), *R. B. Tennent !* 27 May, 1921. Claudelands, Hamilton, *G. H. C.* 24 May, 1922.

The host is endemic, and is abundant throughout. (Cheeseman, 1906, p. 186.)

This rust is common in certain parts of New Zealand, and is conspicuous owing to the bright orange colour of the uredosori ; in certain specimens the entire leaf-surface may be covered with the sori.

The uredo stage alone is known ; the uredospores do not closely resemble other species of the genus, differing particularly in being echinulate and not covered with deciduous tubercules.

I. MELAMPSORACEAE.

Teleutosori waxy. Teleutospores sessile, compacted laterally into a flat crust, seldom solitary within the host-tissues, unicellular, or divided longitudinally into 2–4 cells. Basidium external. Uredosori with or without peridia ; uredospores borne singly on pedicels. Aecidia with or without peridia.

On germination a basidium is produced from the apex of the spore ; this becomes four-celled by transverse septa, and from each cell there arises a sterigma, bearing the basidiospore on its apex. This method of germination, together with the waxy compacted teleutosori, characterize the family.

Nine genera are by Grove (1913, p. 336) included in the family. Arthur (1907) places it, together with the Cronartiaceae, in one family which he has termed the Uredinaceae, including in all eighteen genera. Dietel (1900) includes both the Cronartiaceae and Coleosporiaceae under the Melampsoraceae, including in all fourteen genera.

The following four genera occur in New Zealand :—

KEY TO THE GENERA OF MELAMPSORACEAE.

Uredosori enclosed in peridia, opening by an apical pore.
- Sori on Filicales .. .. 4. *Milesina.*
- Sori on Phanerogams.
  - Teleutospores unicellular, united into lateral flat waxy crusts .. .. 2. *Melampsoridium.*
  - Teleutospores 2–4-celled by vertical septa .. .. 3. *Pucciniastrum.*

Uredosori naked, or surrounded only by paraphyses .. .. 1. *Melampsora.*

1. MELAMPSORA Castagne.

Cast., *Obs. Myc.*, vol. 2, p. 18, 1843.

Physonema Lev., *Ann. Sci. Nat.*, ser. 3, vol. 8, p. 374, 1847. *Podosporium* Lev., *l.c. Podocystis* Fr., *Summa Veg. Scand.*, vol. 2, p. 512, 1849. *Caeoma* Tul., *Ann. Sci. Nat.*, ser. 4, vol. 2, p. 172, 1854. *Uredo* Pers., ex Arth., *N. Am. Fl.*, vol. 7, p. 97, 1907. *Bubakia* Arth., *Res. Sci. Congr. Bot. Vienne*, p. 338, 1906.

Autoecious and heteroecious. Cycle of development includes 0, I, II, III.

0. Spermogones hemisphaerical, flattened, without ostiolar filaments.

I. Caeomata erumpent, without peridia or paraphyses, pulvinate. Caeomatospores globose; catenulate; epispore hyaline, finely verruculose; germ-pores scattered, obscure.

II. Uredosori without peridia, pulverulent, erumpent. Uredospores borne singly on pedicels, intermixed with capitate paraphyses; epispore hyaline, verrucose; germ-pores equatorial or scattered, obscure.

III. Teleutosori indehiscent. Teleutospores compacted laterally into flat waxy irregular dark-coloured layers, unicellular, prismatic or elliptical; epispore coloured, smooth; germ-pore apical, obscure.

Distribution: World-wide. Two indigenous species occur in New Zealand.

The teleutospores form conspicuous chestnut-brown waxy crusts, often 15 mm. long, on the stems and leaves of the hosts. They are closely compacted together, and in consequence appear prismatic in shape.

1. **Melampsora Kusanoi** Dietel. Guttiferae.

Diet., Engl., *Bot. Jahrb.*, vol. 37, p. 104, 1905.

0. Unknown.

II. Uredosori amphigenous, chiefly hypophyllous, scattered, pulverulent, elliptical, 0·2–0·5 mm. long, reddish-orange when fresh, yellowing with age, surrounded by the ruptured epidermis mixed with numerous hyaline capitate paraphyses. Spores subglobose or elliptical, 17–24 × 12–17 mmm.; epispore hyaline, closely and coarsely verruculose, 1·5–2 mmm. thick; germ-pores scattered, 3–4, obscure.

III. Teleutosori hypophyllous, scattered or aggregated in small irregular groups, subepidermal, minute, 0·3–0·5 mm. diam., at first chestnut-brown, becoming black. Spores prismatic, 22–32 × 6–12 mm.; apex rounded or truncate, slightly (2–3 mmm.) thickened; epispore smooth, yellowish, 1 mm. thick: germ-pore apical, obscure.

Host: *Hypericum gramineum* Forst. f. On leaves. Herb. No. 279. II. Alexandra (Otago), 600 m., *G. H. C.* 10 Dec., 1919.

Distribution: Japan; Australia.

The host is indigenous, and is fairly widely distributed; it occurs also in Australia, Tasmania, and New Caledonia. (Cheeseman, 1906, p. 74.)

Only the uredospores have been collected in New Zealand, but both stages have been recorded from Australia by McAlpine (1906, p. 191) as *M. Hypericorum* Schroet.

Sydow has suggested (*Mon. Ured.*, vol. 3, p. 386, 1912) that *Aecidium disseminatum* Berk. is probably the uredo stage of this species; but McAlpine (1906, p. 200) had specimens of an *Aecidium* on *Hypericum japonicum* compared with the type of *Aec. disseminatum* at Kew, when they were found to be identical.

2. **Melampsora Lini** Desmazieres. (Text-fig. 99, and Plate 1, fig. 6.) Linaceae.

Desm., *Pl. Crypt.*, fasc. 41, No. 2049, 1850.

[1] *Uredo Lini* Schum., *Enum. Pl. Saell.*, vol. 2, p. 230, 1803. *Podosporium Lini* Lev., *Ann. Sci. Nat.*, ser. 3, vol. 8, p. 374, 1847. *Podocystis Lini* Fr., *Summa Veg. Scand.*, p. 512, 1849. *Melampsora liniperda* Koern., *Centralbl. f. Bakter*, vol. 32, p. 278, 1911.

0. Spermogones amphigenous, numerous, scattered, immersed, inconspicuous.

I. Caeomata amphigenous, chiefly hypophyllous, scattered, orbicular, 0·2–0·5 mm. diam., orange, pulverulent, surrounded by the ruptured epidermis. Spores subglobose, 20–28 mmm. diam.; epispore hyaline, finely and closely verruculose, 1 mmm. thick, cell-contents vacuolate, yellow.

II. Uredosori amphigenous and caulicolous, scattered or crowded, orbicular, 0·5 mm. diam., on stems elliptical and up to 2 mm. long, pulvinate, pulverulent, surrounded by the ruptured epidermis; mixed with numerous incurved, hyaline, capitate paraphyses. Spores subglobose, obovate or broadly elliptical, 18–24 × 14–18 mmm.; epispore hyaline, closely and finely verruculose, 2 mmm. thick; germ-pores equatorial, obscure.

III. Teleutosori amphigenous and caulicolous, scattered or crowded, often confluent and up to 8 mm. long, irregular, discoid, reddish-brown, becoming shining-black, long covered. Spores laterally compacted, subepidermal, prismatic, unicellular, 40–55 × 9–15 mmm.; apex obtusely rounded or truncate, slightly (3 mmm.) or not thickened, base truncate; epispore smooth, brown, 1 mmm. thick; germ-pore obscure, apical.

Hosts:—

Linum monogynum Forst. On leaves and stems. Herb. Nos. 241, 297. II. York Bay (Wellington), *E. H. Atkinson!* 24 Oct., 1920. II, III. Seashore, Seatoun (Wellington), *E. H. Atkinson!* 27 Jan., 1921.

Linum monogynum Forst. var. *chathamicum* Cockayne. II. York Bay (Wellington), *E. H. Atkinson!* 23 Jan., 1921.

Distribution: Europe; North and South America; Australia.

Both hosts are endemic; they are especially abundant along the seacoasts. (Cheeseman, 1906, p. 86.)

The uredosori are common, and are conspicuous owing to their bright orange colour. The teleutosori appear to be rare here, as only a few sori have been found on the abundant material in hand.

2. Melampsoridium Klebahn.

Kleb., *Zeits. Pflanzenkr.*, vol. 9, p. 21, 1899.

Heteroecious. Cycle of development includes 0, I, II, III.

0. Spermogones globose, flattened, without ostiolar filaments.

I. Aecidia with a well-developed peridium, inflated, cylindrical, erumpent. Aecidiospores globose or elliptical, epispore hyaline, minutely and densely verruculose, thin.

II. Uredosori immersed, enclosed within a definite peridium, opening by an apical pore. Uredospores borne singly on pedicels, elliptical, paraphyses absent; epispore hyaline, echinulate; germ-pores indistinct.

III. Teleutosori indehiscent, subepidermal. Teleutospores compacted laterally into flattened layers, unicellular, elliptical or prismatic; epispore coloured, smooth; germ-pore apical, obscure.

Distribution: Europe; Asia; North America. The solitary New Zealand species has been introduced.

This genus is separated from *Melampsora* on account of the presence of a definite peridium surrounding the aecidio- and uredo-spores, and from *Pucciniastrum* on account of the teleutospores being laterally compacted into waxy layers. It would thus appear to be an intermediate genus, the I and II stages linking it with *Pucciniastrum*, and the teleutospores with *Melampsora*.

1. **Melampsoridium betulinum** Klebahn. (Fig. 100.) Betulaceae.

Kleb., *l.c.*, p. 21.

Uredo Betulae Schum., *Enum. Pl. Saell.*, vol. 2, p. 228, 1803. *Melampsora betulina* Tul., *Ann. Sci. Nat.*, ser. 4, vol. 2, p. 97, 1854. *Aecidium Laricis* Kleb., *Zeits. Pflanzenkr.*, vol. 9, p. 18, 1899. *Peridermium Laricis* Arth. et Kern, *Bull. Torr. Club*, vol. 33, p. 436, 1906. *Melampsoridium Betulae* Arth., *N. Am. Fl.*, vol. 7, p. 110, 1907.

0. Spermogones amphigenous, numerous, scattered, flattened, inconspicuous.

I. Aecidia hypophyllous, solitary, or in rows parallel to the midrib, reddish-orange. Peridia elliptical, up to 1 mm. high, 1 mm. long, margin irregularly torn, tinted. Spores subglobose or elliptical, 16–25 × 12–16 mmm.; epispore hyaline, minutely and closely verruculose, 1–1·5 mmm. thick, slightly thinner and more smooth on one side.

II. Uredosori hypophyllous, immersed, scattered, orbicular, 0·1 mm. diam. Peridia flattened-globose, dehiscing by an apical pore. Spores elliptical or subclavate, 20–35 × 10–15 mmm.; epispore hyaline, sparsely and somewhat coarsely echinulate, smooth towards the apex, 1 mmm. thick; germ-pores indistinct.

III. Teleutosori hypophyllous, immersed, scattered, orbicular, 0·5 mm. diam., chestnut-brown, indehiscent. Spores compacted into a flattened crust, prismatic, 35–45 × 10–15 mmm.; apex and base obtusely rounded; epispore tinted brown, smooth, 1 mmm. thick; germ-pore indistinct.

Host: *Betula alba* L. On leaves. Herb. No. 596. II, III. Hanmer (Canterbury), *W. Morrison!* 2 March, 1922.

Distribution: Europe; Asia; North America. The host is an introduced species.

The aecidia occur on *Larix* spp. Plowright (1890) first worked out the connection between the aecidium on *Larix* and the uredo- and teleutospores on *Betula*. The teleutospores germinate the season following their production.

3. PUCCINIASTRUM Otth.

Otth, *Mitth. d. Nat. Gesellsch. in Bern*, p. 71, 1861.

Phragmopsora Magn., *Hedw.*, vol. 14, p. 123, 1875. *Thekopsora* Magn., *l.c.*

Heteroecious. Cycle of development includes 0, I, II, III.

0. Spermogones flattened-globose, without ostiolar filaments.

I. Aecidia with definite peridia, erumpent. Peridia cylindrical. Aecidiospores elliptical; epispore hyaline, thin, verruculose, except on one side where it is smooth and thinner; germ-pores indistinct.

II. Uredosori surrounded by a delicate hyaline peridium, opening by an apical pore, subepidermal. Uredospores borne singly on pedicels, obovate or elliptical; epispore hyaline, echinulate; germ-pores indistinct.

III. Teleutosori indehiscent, forming definite layers beneath the epidermis. Teleutospores 2–4-celled by vertical septa in two planes, elliptical or prismatic; epispore smooth, coloured; germ-pore indistinct.

Distribution: Europe; Asia; North and South America.

The following indigenous species is the sole representative of the genus that has been collected in New Zealand.

Germination as in *Melampsora*, save that as a rule only one basidium is produced from any one spore, whether 1- or 4-celled.

1. Pucciniastrum pustulatum Dietel. (Fig. 98.) Onagraceae.

Diet. in Engler and Prantl *Nat. Pflanzenfam.*, vol. 1 [1]**, p. 47, 1900.

Uredo pustulata Pers., *Syn. Fung.*, p. 219, 1801. *U. Epilobii* DC., *Fl. Fr.*, vol. 6, p. 73, 1815. *Caeoma Epilobii* Link., in *Willd. Sp. Pl.*, vol. 6, p. 29, 1825. *Pucciniastrum Epilobii* Otth., *Mitth. Nat. Ges. Bern*, p. 72, 1861. *Melampsora pustulata* Schroet., *Krypt. Fl. Schles.*, vol. 3, p. 364, 1887. *Pucciniastrum Abieti-Chamaenerii* Kleb., *Jahrb. Wiss. Bot.*, vol. 34, p. 387, 1900.

0. Spermogones hypophyllous, flattened, abundant, subcuticular.

I. Aecidia hypophyllous, mostly in two rows corresponding to the white lines of the leaf, 0·25 mm. diam. Peridia hyaline, 1 mm. high, dehiscing by longitudinal fissure or irregular rupture of the apex, cylindrical, erect, not revolute, margin lacerate, hyaline. Spores obovate or subglobose, 13–22 × 10–14 mmm.; epispore hyaline, finely and moderately verruculose, with an elongated smooth area on one side, 1–1·5 mmm. thick.

II. Uredosori amphigenous, chiefly hypophyllous, scattered, or frequently crowded in small groups which are seated on irregular discoloured spots, sulphur-yellow, orbicular, 0·1–0·3 mm. diam., bullate, immersed, somewhat pulverulent, opening by an apical pore. Peridia flattened-globose, delicate, hyaline. Spores obovate, polygonal, or elliptical, 15–24 × 10–15 mmm.; epispore hyaline, finely and moderately echinulate, 1 mmm. thick, cell-contents pallid orange; germ-pores indistinct; paraphyses absent.

III. Teleutosori hypophyllous, flattened, 0·25 mm. diam., scattered or confluent, irregular, chestnut-brown, indehiscent. Spores cylindrical or prismatic, 17–35 × 7–14 mmm.; apex obtusely rounded or truncate, thickened to 3 mmm., base truncate; epispore smooth, chestnut-brown, 1 mmm. thick; germ-pore indistinct.

Host: *Epilobium pubens* A. Rich. On leaves. Herb. No. 756. II. Tiritea, Palmerston North (Wellington), 300 m., *G. H. C.* 3 Mar., 1921.

Distribution: Europe; North America.

The host is indigenous, and is widespread; it occurs also in Australia. (Cheeseman, 1906, p. 175.)

In Europe and North America the aecidia occur on *Abies pectinata* DC. The uredo stage has been described from New Zealand material, but the aecidia and teleuto stages have been described from material kindly supplied by Dr. J. R. Weir (herb. J. R. Weir, No. 11555) and Mrs. F. W. Patterson (U.S. Dept. Agr. Myc. Exc., Nos. 744, 745).

The uredosori are small and easily overlooked, largely on account of their being immersed in the host-tissues; their presence is, as a rule, indicated by the presence of small dead areas on the leaf.

4. Milesina Magnus.

Magn., *Ber. Deutsch. Bot. Gesell.*, vol. 27, p. 324, 1909.

Milesia White, *Scot. Nat.*, vol. 4, p. 162, 1877.

Autoecious. Cycle of development includes II, III. On Filicales.

II. Uredosori with a definite peridium, opening by an apical pore, subepidermal. Uredospores obovate or elliptical, borne singly on pedicels; epispore hyaline, thin, echinulate; germ-pores indistinct.

III. Teleutosori subepidermal, intracellular. Teleutospores 2–4-celled by vertical septa, elliptical; epispore smooth, hyaline; germ-pores indistinct, apical.

Distribution: Europe; North America.

The genus is confined to the Filicales. Apparently the teleutospores are rare in nature, as they appear to have been collected but once. Prior to their discovery this genus was known as *Milesia*, but, as it was erected on an imperfect stage that may have belonged to any one of several genera, it has been relegated to synonymy.

Besides *Milesina*, *Hyalopsora* Magn. and *Uredinopsis* Magn. (both included in the Melampsoraceae) are also confined to the Filicales. Of these two, *Hyalopsora* differs from *Milesina* in the peridium being absent, and the germ-pores of the uredospores being numerous and conspicuous; the teleutosori are similar to *Milesina*. In *Uredinopsis* two kinds of uredospores occur, both enclosed in peridia; the first type of uredospore is subangular, and has a hyaline roughened epispore; the second type consists of fusoid uredospores, the apex of each spore being crowned with an elongated sharply-pointed hyaline papilla, which may be as long again as the spore; the teleutospores are solitary, extracellular, septate, and appear to be scattered—without arrangement into sori—throughout the mesophyll-cells of the host.

1. **Milesina Histiopteridis** n. sp. (Text-fig. 101, and Plate 1, fig. 5.)
Polypodiaceae.

II. Uredosori hypophyllous, scattered, or more commonly crowded in groups which are linear, intercostal, and up to 15 mm. long, seated on irregular discoloured spots visible on the upper surface, 0·25–0·5 mm. diam., orbicular, bullate, covered by the epidermis, opening by an irregular apical pore. Peridium flattened-globose, ostiolate, composed of obovate, hyaline cells, outer wall coarsely and densely verruculose. Spores obovate, elliptical, or polygonal, 18–26 × 14–18 mmm.; epispore hyaline, moderately and finely verrucose, 0·75-1 mmm. thick, cell-contents colourless, vacuolate; germ-pores indistinct.

III. Unknown.

Host: *Histiopteris incisa* (Thunb.) J. Sm. (= *Pteris incisa* Thunb.). On fronds. Herb. Nos. 772, 774. II. Karori (Wellington), 400 m., *E. H. Atkinson!* 27 April, 1922. Kelburn (Wellington), 120 m., *E. H. Atkinson! G. H. C.* 17 Sept., 1922. (Type.)

The very thin, moderately and finely verrucose epispore serves to separate this from other species of the genus. The rust is exceedingly common in the localities where it has been collected; in fact, scarcely a frond could be obtained free from the dead areas in which the uredosori are embedded.

IV. UREDINALES IMPERFECTI.

Under this heading are grouped all those forms (such as *Aecidium*, *Uredo*, &c.) belonging to the cycle of species whose teleutospore stage is unknown. These various forms were at one time believed to be separate entities, and accordingly were named and described separately, even when associated on the same host. As a result of the classical experiments performed by De Bary (1865), numerous investigators began to experiment with cultures and link up the various forms with their teleutospore or perfect form, and so a great number of the names applied to the different forms were gradually relegated to synonymy. In many cases, however, despite extensive cultural experiments, certain forms still remain unconnected with any teleutospore stage, in consequence of which it is

necessary to maintain form-genera to contain these. Again, in any country where little or no cultural work has been performed (as in New Zealand and Australia), many of these forms appear in systematic papers dealing with the Uredinales. It is usual to assume, when a certain aecidium or uredo stage is regularly found in proximity with the teleutosori, that this (or these) form belongs to the cycle to which the teleutospores in question belong. This is not a safe practice to follow, and much caution is necessary, as forms have frequently been found associated with teleutospores which later investigators have proved to belong to some entirely different fungus. Field investigations generally give some indication as to the probable relationships of the forms found on the same or adjacent hosts, so that in many cases it becomes a simple matter to supplement these observations with cultural experiments.

Five forms are generally recognized, as follows: *Aecidium*, *Caeoma*, *Peridermium*, *Roestelia*, and *Uredo*. Their characters may be summarized in the following key:—

KEY TO FORM-GENERA.

Spores catenulate.	
Peridium present.	
On Gymnospermae	*Peridermium.*
On Angiospermae.	
Epispore coloured brown: germ-pores conspicuous ..	*Roestelia.*
Epispore hyaline or tinted yellow: germ-pores indistinct	*Aecidium.*
Peridium absent	*Caeoma.*
Spores borne singly on distinct pedicels	*Uredo.*

Of these form-genera two only are discussed in this paper. *Peridermium* occurs in the cycle of *Coleosporium*, *Cronartium*, and *Melampsoridium*; it is confined to the Coniferae. *Roestelia* occurs only in the cycle of *Gymnosporangium*; it merges into *Aecidium*, but is separated on account of the horn-like peridium, brown-coloured epispore, and conspicuous germ-pores. *Caeoma* occurs in the cycle of *Phragmidium*, *Melampsora*, and *Gymnoconia*. It is characterized by the absence of a peridium, and by the fact that the spores are catenulate; in certain genera the caeomata are surrounded by paraphyses. *Aecidium* and *Uredo* are discussed more fully below.

1. AECIDIUM Persoon.

Pers. in J. F. Gmel., *Syst. Nat.*, vol. 2, p. 1472, 1791.

0. Spermogones immersed, flask-shaped, with protruding ostiolar filaments, honey-coloured, preceding or accompanying aecidia.

I. Aecidia at first immersed, becoming erumpent, cupulate or cylindrical, scattered, or grouped, when usually seated on somewhat inflated spots. Peridia hyaline, less frequently tinted yellow, margins erect or revolute, dentate or lacerate, seldom entire, dehiscing by the irregular rupture of the apex; formed of polygonal or rhombohedral cells which are striate or verruculose on one surface, hollow, colourless or with the central cavity filled with an oily and coloured matrix, usually overlapping. Aecidiospores catenulate, polygonal, elliptical or subglobose: epispore commonly hyaline, seldom tinted yellow, usually verruculose, with numerous scattered indistinct germ-pores.

Distribution: World-wide.

This form occurs in the cycle of certain species of *Uromyces* and *Puccinia*. The mycelium is frequently perennial, and usually causes etiolation and distortion of the host. As time permits I hope to work out the cycles of all New Zealand Uredinales by the aid of cultures, so that many of the forms listed here will doubtless be later listed as synonyms.

Eleven species of *Aecidium* are recorded here; of these, nine are endemic and two indigenous.

KEY TO THE FORM-SPECIES OF AECIDIUM.

Host belonging to the family Ranunculaceae.
  Aecidia on large distorted areas .. .. .. 1. *A. otagense.*
  Aecidia in small groups, not on distorted areas .. 2. *A. Ranunculacearum.*
Host belonging to the family Leguminosae .. .. 3. *A. kowhai.*
Host belonging to the family Tiliaceae .. .. 4. *A. Milleri.*
Host belonging to the family Myoporaceae .. .. 5. *A. Myopori.*
Host belonging to the family Plantaginaceae .. .. 6. *A. Plantaginis-variae.*
Host belonging to the family Rubiaceae .. .. 7. *A. hupiro.*
Host belonging to the family Compositae.
  Epispore minutely verruculose.
    Aecidia crowded in distorted areas .. .. 11. *A. Macrodontae.*
    Aecidia scattered .. .. 9. *A. Celmisiae-petiolatae.*
  Epispore covered with deciduous tubercules.
    Spores obovate or elliptical .. .. .. 8. *A. Celmisiae-discoloris.*
    Spores elongate-elliptical .. .. .. 10. *A. Celmisiae-Petriei.*

1. **Aecidium otagense** Lindsay. (Fig. 102.) Ranunculaceae.

Linds., *Trans. Roy. Soc. Edinb.*, vol. 24, p. 430, 1866.

0. Spermogones associated with the aecidia, immersed, honey-coloured.

I. Aecidia amphigenous, caulicolous, petiolicolous and sepalicolous, crowded in inflated distorted areas which may attain a length of 15 cm., orange. Peridia cupulate, shortly erumpent, 0·5–1 mm. diam., margins revolute, yellow, deeply and irregularly lacerate. Spores globose or polygonal, 23–36 mmm. diam.; epispore hyaline, delicately and closely verruculose, 0·75 mmm. thick, cell-contents granular, orange.

Hosts :—

Clematis indivisa Willd. On leaves, stems, petioles, and sepals Herb. Nos. 188, 434. Lake Horowhenua, Levin (Wellington), 30 m., *E. H. Atkinson!* 26 Oct., 1919. Peel Forest (Canterbury), *H. H. Allan!* 8 Nov., 1919. Manawatu Gorge (Wellington), 150 m., *J. W. Whelan!* 29 Sept., 1921. Putara, Eketahuna (Wairarapa), *H. Watson!* 8 Nov., 1921.

Clematis Colensoi Hook. f. On stems and petioles. Herb. No. 231. Miramar (Wellington), 20 m., *J. W. Bird!* 5 Nov., 1920.

Distribution: Endemic; common throughout.

The hosts are endemic, and are abundant throughout. (Cheeseman, 1906, pp. 2, 3.)

This rust forms conspicuous distorted areas, many centimetres long, on the stems and leaves of the hosts. The mycelium is perennial, so that once a plant has become infected the rust appears season after season. The specimens on *Clematis Colensoi* are badly infected with *Tuberculina persicina* (Ditm.) Sacc. (see Appendix, p. 50). Lindsay records the rust upon *Clematis hexasepala* DC.

The aecidia of this species are formed within the host-tissues in the vicinity of the phloem, and all stages may be obtained from immature to fully-developed peridia containing numerous spores. As they develop, the peridia move towards the periphery of the stem, and prior to dehiscence may be found fully developed lying beneath the epidermis. That they are mature is evidenced by the behaviour of the spores, for on being placed in water these give rise to infection hyphae.

2. Aecidium Ranunculacearum De Candolle. (Text-fig. 103, and Plate 1, fig. 8.)
DC., *Fl. Fr.*, vol. 6, p. 97, 1805.

0. Spermogones amphigenous, crowded in small groups, mixed with the aecidia, immersed, honey-coloured.

I. Aecidia amphigenous and petiolicolous, crowded in scattered groups, which are seated on slightly inflated spots visible on the opposite surface, on leaves the groups are orbicular and up to 5 mmm. diam., on stems they are elliptical and up to 10 mm. long; orange. Peridia cupulate, immersed, and partly erumpent, 0·25 mm. diam., margins 0·5–1 mm. high, erect, slightly expanded, not revolute, brittle, white, finely lacerate. Spores polygonal, elliptical, or subglobose, 20–37 × 18–28 mmm.; epispore hyaline, closely and minutely verruculose, 1 mmm. thick, cell-contents pallid orange, granular.

Hosts :—

Ranunculus depressus T. Kirk. On leaves and petioles. Herb. No. 81. Mount Guinevere (Canterbury), *W. D. Reid!* 15 Oct., 1919.

Ranunculus geraniifoliis Hook. f. Herb. No. 315. Mount Hector (Wellington), 1,500 m., *E. H. Atkinson!* 6 Feb., 1921.

Ranunculus insignis Hook. f. Herb. No. 372. Mount Dennan (Wellington), 1,500 m., *E. H. Atkinson!* 7 Jan., 1922.

Ranunculus Lyallii Hook. f. Herb. No. 81. Waimakariri glaciers, *T. Kirk!* Jan., 1883. McKinnon's Pass (Otago), *E. H. Atkinson!* 16 Jan., 1920. Sugarloaf, Cass (Canterbury), 650 m., *W. D. Reid! N. R. Foy!* 20 Jan., 1922. Punch-bowl Falls, Arthur's Pass (Canterbury), 1,000 m., *E. H. Atkinson!* 15 Nov., 1922.

Ranunculus nivicola Hook. Herb. No. 496. Mount Egmont (Taranaki), 1,200–1,500 m., *W. D. Reid! N. R. Foy!* 2 Jan., 1922.

Ranunculus pachyrrhizus Hook. f. Herb. No. 372. Lake Harris (Otago), 1,100 m., *W. D. Reid!* 6 May, 1921.

Ranunculus repens L. Herb. No. 81. Weraroa (Wellington), 100 m., *E. H. Atkinson! G. H. C.* 3 Oct., 1919. Sandhills, Levin (Wellington), 30 m., *E. H. Atkinson! G. H. C.* 14 Oct., 1922.

Distribution: World-wide.

With the exception of *Ranunculus repens* L. all the hosts are endemic. They are all confined to the mountain-ranges. *R. insignis* and *R. geraniifoliis* occurs in both Islands; *R. nivicola* is confined to the North Island, and *R. Lyallii*, *R. pachyrrhizus*, and *R. depressus* to the South Island. (Cheeseman, 1906, pp. 9–24.)

The aecidium on *R. repens* may belong to the cycle of any one of several species—for example, *Uromyces Dactylidis* Otth, *U. Poae* Rab., and *Puccinia Magnusiana* Koern. As its connection with those species mentioned above which occur in New Zealand has not yet been worked out, it is retained here for the present. The forms on the several hosts discussed above do not agree with one another in all particulars, differing slightly in the size of the spores as well as in minor details of the peridia; these differences are so slight, and merge one into the other so closely, that it is not possible to separate any one form as being sufficiently distinct to warrant its being raised to specific or even varietal rank.

(A drawing of a spermogone of this species is given in *Trans. N.Z. Inst.*, vol. 54, p. 620). On *Ranunculus Lyallii* the spermogones precede the aecidia, and may frequently be found arranged in small groups, quite covering the surfaces of the leaves.

3. **Aecidium kowhai** n. form-sp. (Text-fig. 104, and Plate 1, fig. 10.)

Leguminosae.

0. Unknown.

I. Aecidia caulicolous, crowded in longitudinal groups, seated on fusiform swellings up to 7 cm. long, forming large fastigiate distortions, orange-yellow. Peridia cupulate, shortly erumpent, standing above the surface 0·25 mm., 0·5 mm. diam., expanded and slightly revolute, becoming lacerate, finally eroded, tinted yellow. Spores polygonal or elliptical, 27–32 × 18–21 mmm.; epispore hyaline, densely and minutely verruculose, 1 mmm. thick, cell-contents granular, lemon-yellow.

Host: *Edwardsia tetraptera* (J. Miller) Oliver (= *Sophora tetraptera* J. Mill.). On branches. Herb. No. 763. Brightwater (Nelson), 200 m., *C. Nash! W. C. Hyde! G. H. C.* 18 May, 1922. (Type.)

The host is indigenous and widespread; it occurs also in Lord Howe Island, Easter Island, Juan Fernandez, and Chile. (Cheeseman, 1906, p. 123.)

This rust forms conspicuous "witch's-brooms" on the host. A branch becomes infected near the tip, and further outward growth is prevented. In the vicinity of the infected area numerous short laterals are produced; these in turn may give rise to tertiary laterals, until the whole assumes a dense and shrubby appearance. Infected shoots become swollen to several times their normal thickness, and in these inflated areas the aecidia appear. The mycelium is perennial, and material may be collected from infected plants throughout the year.

I am indebted to Mr. C. Nash and Mr. W. C. Hyde for assistance in procuring these specimens.

4. **Aecidium Milleri** n. form-sp. (Text-fig. 105, and Plate 1, fig. 7.)

Tiliaceae.

0. Unknown.

I. Aecidia hypophyllous, in minute scattered groups, 3–6 in a group, seated on pallid spots visible on the upper surface, pallid orange. Peridia cupulate, erumpent, 0·25 mm. diam., margins erect, not expanded or revolute, minutely dentate, white. Spores subglobose or polygonal, 20–26 × 17–23 mmm.; epispore hyaline, minutely and densely verruculose, 1 mmm thick, cell-contents tinted yellow, vacuolate.

Host: *Aristotelia serrata* (Forst.) Oliver (= *A. racemosa* (A. Cunn.) Hook. f.). On leaves. Herb. No. 776. Pokaka (Waimarino County), 800 m., *D. Miller!* 10 Feb., 1922. (Type.)

The host is endemic, and is widely spread throughout the lowland forests. (Cheeseman, 1906, p. 83.)

This species is named in honour of the collector, David Miller, Government Entomologist, Biological Laboratory, Wellington.

The aecidia occur in small groups of 3–6, each group being somewhat angular, and about 1 mm. in diameter.

5. **Aecidium Myopori** n. form-sp. (Text-fig. 106, and Plate 1, fig. 11.)

Myoporaceae.

0. Unknown.

I. Aecidia caulicolous, truncicolous, petiolicolous, and on inflorescences and drupes, seated on inflated fusiform areas up to 15 cm. long, crowded in linear groups, orange. Peridia erumpent, cylindrical, standing above the surface about 4 mm., 1 mm. diam., margins slightly expanded but

not revolute, deeply and irregularly lacerate, tinted orange, bleaching white with age. Spores obovate, elliptical, irregularly polygonal or less commonly lachrymiform, 21–45 × 17–20 mmm.; epispore hyaline, finely and closely verruculose, 1 mmm. thick, cell-contents reddish-orange, germ-pores indistinct.

Host: *Myoporum laetum* Forst. f. On branches, trunks, petioles, inflorescences, and drupes. Herb. Nos. 404, 777. Palmerston North (Wellington), 250 m., *G. H. C.* Feb., May, Dec., 1921; Feb., May, 1922. (Type.) Woodside Creek, Wharanui (Marlborough), *E. H. Atkinson!* 3 Nov., 1922.

The host is endemic, and is widespread. (Cheeseman, 1906, p. 563.)

This species forms large fusiform swellings on the branches of the host; as a rule it occurs on laterals, forming "witch's-brooms," but it is not confined to these, as I have collected it on large trunks 30 cm. in diameter. The peridia resemble those of the form-genus *Roestelia*, but only in size and shape, for they dehisce apically and not throughout their length; moreover, the spores are characteristic of *Aecidium*, the epispore being hyaline and minutely verruculose, and the germ-pores are indistinct. The spores vary considerably in size and shape; the measurements given above are taken from average spores, for if the lachrymiform ones were measured they would give an entirely erroneous impression as to the average size, they being more than twice as long as the average spores

It is probable that the mycelium is perennial, as the fungus may be obtained throughout the year from infected plants.

6. **Aecidium Plantaginis-variae** McAlpine. (Fig. 107.) Plantaginaceae.

McAlp., *Rusts Aust.*, p. 195, 1906.

0. Spermogones amphigenous, chiefly epiphyllous, immersed, numerous.

I. Aecidia amphigenous and petiolicolous, scattered or gregarious, orange-yellow. Peridia slightly erumpent, cupulate, 0·2–0·25 mm. diam., tinted cream, margins slightly expanded, not revolute, minutely dentate. Spores subglobose, polygonal, or elliptical, 20–30 × 18–22 mmm., epispore hyaline, densely and minutely verruculose, 1 mmm thick, cell-contents granular, yellow.

Host: *Plantago spathulata* Hook. f. On leaves and petioles. Herb. No. 275. Burke's Pass (Canterbury), *W. D. Reid!* 18 Nov., 1919.

Distribution: Victoria; New South Wales; Tasmania.

The host is endemic, and, although not uncommon in the South Island, is confined to a few localities in the North. (Cheeseman, 1906, p. 571.)

This species is characterized by the scattered, small-sized aecidia.

7. **Aecidium hupiro** n. form-sp. (Text-fig. 109, and Plate 1, fig. 9.) Rubiaceae.

0. Spermogones amphigenous, immersed, honey-coloured, surrounded by the aecidia.

I. Aecidia hypophyllous, crowded in irregularly-circular groups, seated on discoloured and slightly-inflated areas visible on the upper surface, yellow. Peridia erumpent, cylindrical, 1 mm. high, 0·4–0·5 mm. diam., margins erect, not revolute, irregularly lacerate, tinted yellow. Spores polygonal or elliptical, 42–50 × 34–40 mmm.; epispore hyaline, densely and coarsely verruculose, 2–5·5 mmm. thick, cell-contents coarsely granular, pallid yellow.

Host: *Coprosma foetidissima* Forst. On leaves and petioles. Herb. No. 771. Alpha Hut, Mount Hector (Wellington), 1,700 m., *H. Hamilton! J. G. Myers!* 15 Feb., 1921.

The host is endemic, and is abundant throughout. (Cheeseman, 1906, p. 259.)

The upright cylindrical peridia and large size of the spores serve to characterize this species.

8. **Aecidium Celmisiae-discoloris** n. form-sp. (Text-fig. 111, and Plate 2, fig. 2.) Compositae.

0. Spermogones scattered, sparse, epiphyllous, immersed.

I. Aecidia amphigenous, chiefly epiphyllous, orange-yellow, scattered or arranged in small orbicular groups. Peridia cylindrical, erumpent, standing 1 mm. above the leaf-surface, 0·1 mm. diam., margins incurved, at first dentate, becoming deeply lacerate, white. Spores subglobose, elliptical, or obovate, 36–42 × 28–34 mmm.; epispore hyaline, covered with densely-packed deciduous tubercules, 3 mmm. thick, cell-contents orange-yellow, granular.

Hosts:—

Celmisia discolor Hook. f. On leaves. Herb. No. 384. Mount Peel (Canterbury), 900 m., *H. H. Allan!* 6 March, 1921. Tooth Peaks (Otago), *W. D. Reid!* 7 April, 1921. (Type.)

Celmisia Sinclairii Hook. f. Herb. Nos. 385, 435. Lake Harris track (Otago), 1,000 m., *W. D. Reid!* 6 May, 1921. Mount Isobel, Hanmer (Canterbury), 1,200 m., *W. D. Reid!* 4 Nov., 1921.

Celmisia prorepens Petrie. Herb. No. 385. Mount Dick (Otago), 1,400 m., *W. D. Reid!* 24 April, 1921.

All three hosts are endemic, and all are confined to the mountain-ranges of the South Island. (Cheeseman, 1906, pp. 303–6.)

This species is characterized by the small cylindrical peridia, and more especially by the fact that the epispore is covered with a layer of closely-packed, coarse, deciduous tubercules. *Aecidium Celmisiae-Petriei* is the only other New Zealand species that possesses this feature.

9. **Aecidium Celmisiae-petiolatae** n. form-sp. (Text-fig. 110, and Plate 2, fig. 3.)

0. Unknown.

I. Aecidia hypophyllous, seated on discoloured spots visible on the upper surface, scattered or more commonly in small orbicular groups, pallid orange. Peridia flattened-globose, 0·25 mm. diam., immersed, margins incurved, hyaline, covered by the dense tomentum clothing the leaf-surface. Spores polygonal, elliptical, or obovate, 27–45 × 20–26 mmm.; epispore hyaline, densely and minutely verruculose, 1–1·5 mmm. thick, cell-contents granular, tinted yellow.

Host: *Celmisia petiolata* Hook. f. On leaves. Herb. No. 383. Arthur's Pass, Canterbury, 1,000 m., *E. H. Atkinson!* 15 Feb., 1920. (Type.)

The host is endemic, and is confined to the mountain regions of the southern portion of the South Island. (Cheeseman, 1906, p. 307.)

This rust is characterized by the depressed-globose aecidia, large spores, and hyaline, finely verruculose epispore. Sections are necessary to determine the shape and size of the peridium.

10. Aecidium Celmisiae-Petriei n. form-sp. (Text-fig. 112, and Plate 2, fig. 4.)

0. Spermogones scattered, sparse, seen only in sections.

I. Aecidia hypophyllous, in linear groups, seated on discoloured spots visible on the upper surface, forming conspicuous bullate areas beneath the tomentum of the leaf, long covered. Peridia cylindrical, 0·25 mm. diam., distorted by pressure of the overlying tomentum, margins incurved, deeply and irregularly lacerate, white. Spores elongate-elliptical, or obovate-elliptical, 36–52 × 20–25 mmm.; epispore hyaline, densely covered with deciduous tubercules, 2 mmm. thick, cell-contents granular, orange-yellow.

Host: *Celmisia Petriei* Cheesem. On leaves. Herb. No. 382. Lake Harris track (Otago), 1,100 m., *W. D. Reid!* 6 May, 1921. (Type.)

The host is endemic, and confined to the mountains of Otago. (Cheeseman, 1906, p. 311.)

This species differs from others on *Celmisia* on account of the elliptic-oblong spores, and the presence of deciduous tubercules on the epispore. The aecidia are permanently covered by the dense tomentum which clothes the leaf-surface; this soon causes the peridia to become malformed, so that sections of young specimens are necessary to determine the shape and size of the peridium.

11. Aecidium Macrodontae n. form-sp. (Text-fig. 108, and Plate 2, fig. 1.)

0. Spermogones amphigenous, chiefly epiphyllous, sparse, associated with the aecidia.

I. Aecidia hypophyllous and petiolicolous, crowded in irregularly-shaped groups up to 10 mm. long, seated on discoloured distorted spots visible on

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Fig. 102.—*Aecidium otagense* Linds. Aecidiospores from *Clematis indivisa* Willd.

Fig. 103.—*Aecidium Ranunculacearum* DC. Aecidiospores from *Ranunculus Lyallii* Hook. f.

Fig. 104.—*Aecidium kowhai* G. H. Cunn. Aecidiospores from *Edwardsia tetraptera* (J. Mill) Oliver.

Fig. 105.—*Aecidium Milleri* G. H. Cunn. Aecidiospores from *Aristotelia serrata* (Forst.) Oliver.

Fig. 106.—*Aecidium Myopori* G. H. Cunn. Aecidiospores from *Myoporum laetum* Forst. f. Note large lachrymiform spore on the left.

Fig. 107.—*Aecidium Plantaginis-variae* McAlp. Aecidiospores from *Plantago spathulata* Hook. f.

Fig. 108.—*Aecidium Macrodontae* G. H. Cunn. Aecidiospores from *Olearia macrodonta* Baker.

Fig. 109.—*Aecidium hupiro* G. H. Cunn. Aecidiospores from *Coprosma foetidissima* Forst.

Fig. 110.—*Aecidium Celmisiae-petiolatae* G. H. Cunn. Aecidiospores from *Celmisia petiolata* Hook. f.

Fig. 111.—*Aecidium Celmisiae-discoloris* G. H. Cunn. Aecidiospores from *Celmisia discolor* Hook. f. Note the coarse deciduous tubercules with which the epispore is covered.

Fig. 112.—*Aecidium Celmisiae-Petriei* G. H. Cunn. Aecidiospores from *Celmisia Petriei* Cheesem. Note decidious tubercles.

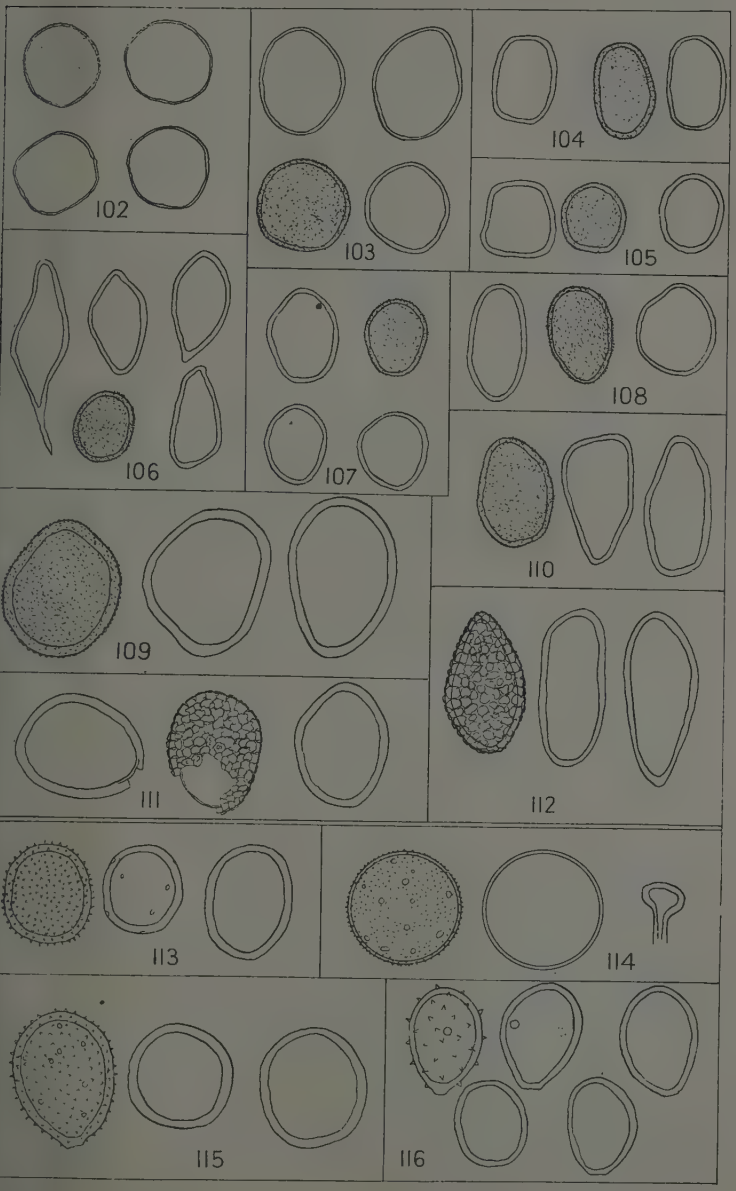
Fig. 113.—*Uredo toetoe* G. H. Cunn. Uredospores from *Arundo conspicua* Forst. f.

Fig. 114.—*Uredo Crinitae* G. H. Cunn. Uredospores from *Dichelachne crinita* (Forst. f.) Hook. f.

Fig. 115.—*Uredo karetu* G. H. Cunn. Uredospores from *Hierochloe redolens* (Forst. f.) R. Br.

Fig. 116.—*Uredo Scirpi-nodosi* McAlp. Uredospores from *Scirpus inundatus* Poir.

All figures × 500.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the upper surface, pallid yellow. Peridia immersed, the margins alone showing, 0·1–0·2 mm. diam., margins incurved, dentate, white. Spores polygonal, elliptical, or obovate, 25–37 × 18-24 mmm.; epispore hyaline, densely and rather coarsely verruculose, 1 mmm. thick, cell-contents tinted yellow, granular.

Host: *Olearia macrodonta* Baker. On leaves and petioles. Herb. No. 277. The track, Clinton Valley (Otago), *E. H. Atkinson!* 18 Jan., 1920. (Type.)

The host is endemic, and is abundant throughout. (Cheeseman, 1906, p. 286.)

This species is separated from *Aecidium Olearíae* McAlp. on account of the much larger spores. Moreover, the minute immersed peridia and distorting habit are distinctive features.

2. Uredo Persoon.

Pers., *Neues. Mag. Bot. Roemer*, vol. 1, p. 93, 1794.

II. Uredosori without peridia, frequently surrounded by or mixed with paraphyses, erumpent, definite, pulverulent, bullate or pulvinate, usually surrounded by the ruptured epidermis, sometimes long covered. Uredospores borne singly on pedicels, never catenulate, globose, elliptical, or obovate; epispore hyaline or coloured, verrucose or more commonly echinulate, seldom smooth; germ-pores 2 to several, scattered or equatorial, conspicuous or indistinct, sometimes papillate. Germinating by the protrusion of a germ-tube which penetrates the host-tissues through the stomata.

Distribution: World-wide.

This form occurs in the cycle of certain species belonging to the families Pucciniaceae (excluding *Gymnosporangium*), Cronartiaceae, Coleosporiaceae, and Melampsoraceae, and is in fact the commonest of all spore-forms occurring in the Uredinales.

The form-genus is characterized by the spores being borne singly on pedicels, not in chains, and by the fact that the sori are naked and not contained within peridia.

Twelve form-species are recorded in this paper; of these, nine are endemic, and the remaining three indigenous.

Key to Form-species of Uredo.

Hosts belonging to the family Gramineae.
  Spores over 30 mmm. long.
    Epispore thin, 1 mmm. .. .. 1. *U. Crinitae.*
    Epispore thick, 2 mmm. or more .. .. .. 2. *U. karetu.*
  Spores under 30 mmm. long .. .. 3. *U. toetoe.*
Hosts belonging to the family Cyperaceae .. .. 4. *U. Scirpi-nodosi.*
Hosts belonging to the family Liliaceae.
  Epispore minutely and closely echinulate .. .. 5. *U. Dianellae.*
  Epispore coarsely and sparsely echinulate .. .. 6. *U. Phormii.*
Hosts belonging to the family Chenopodiaceae .. .. 7. *U. Rhagodiae.*
Hosts belonging to the family Umbelliferae .. .. 8. *U. inflata.*
Hosts belonging to the family Compositae.
  Epispore thin, 2 mmm. and under.
    Epispore closely and finely echinulate .. .. 11. *U. tupare.*
    Epispore coarsely and moderately echinulate .. 12. *U. wharanui.*
  Epispore thick, 3–6 mmm.
    Spores over 40 mmm. long .. .. .. 9. *U. Olearíae.*
    Spores under 40 mmm. long .. .. .. 10. *U. southlandicus.*

1. Uredo Crinitae n. form-sp. (Fig. 114.) Gramineae.

II. Uredosori amphigenous, seated on discoloured spots, scattered, seldom confluent, elliptical, 1 mm. long, reddish-orange, pulverulent, surrounded by the ruptured epidermis. Spores globose or subglobose, 38–41 mmm. diam.; epispore hyaline, closely and finely echinulate, 1 mmm. thick, cell-contents orange-yellow, granular; germ-pores scattered, numerous (12–18), conspicuous; mixed with and partially surrounded by numerous hyaline, capitate paraphyses.

Host: *Dichelachne crinita* (Forst. f.) Hook. f. On leaves. Herb. No. 760. Akaroa (Banks Peninsula), 300 m., *W. D. Reid!* 16 Jan., 1922. (Type.)

The host is indigenous and is widespread; it occurs also in Australia and Tasmania. (Cheeseman, 1906, p. 873.)

This rust is readily distinguished from any other on the Gramineae by the large globose spores, thin hyaline finely-echinulate epispore, and numerous scattered, conspicuous germ-pores.

2. Uredo karetu n. form-sp. (Fig. 115.)

II. Uredosori hypophyllous, seated on dark-coloured spots visible on the upper surface, linear, 1 mm. long, seldom confluent, pulverulent, orange-yellow, surrounded by the ruptured epidermis. Spores subglobose or obovate, 34–45 × 30–35 mmm.; epispore tinted yellow, finely and moderately echinulate, 2–2·5 m. thick, cell-contents yellow, granular; germ-pores scattered, numerous (8–12), obscure.

Host: *Hierochloe redolens* (Forst. f.) R. Br. On leaves. Herb. No. 762. Sea-level, Bluff (Southland), *W. D. Reid!* 26 May, 1922. (Type.)

The host is indigenous, and is abundant in moist places throughout; it occurs also in Fuegia, Tasmania, and Victoria. (Cheeseman, 1906, p. 855.)

This rust is characterized by the large size of the spores, thick, finely-echinulate epispore, and numerous scattered obscure germ-pores. *Puccinia Hierochloae* S. Ito, a species belonging to the *P. coronata* group on account of the coronate apex of the teleutospores, differs in the uredospore stage from that described above, the uredospores of this species being much smaller (16–27 × 12–18 mmm.). It was first described from Japan by Ito (1909).

3. Uredo toetoe n. form-sp. (Fig. 113.)

II. Uredosori hypophyllous, scattered, seated on discoloured spots visible on the upper surface, elliptical, 0·5–1 mm. long, or confluent and up to 4 mm. long, bright reddish-brown, pulverulent, naked or surrounded by the ruptured epidermis. Spores elliptical or subglobose, 20–30 × 20–26 mmm.; epispore reddish-brown, finely and closely echinulate, 1·5–2 mmm. thick, cell-contents granular, brown; germ-pores scattered, numerous (7–12), conspicuous, papillate.

Host: *Arundo conspicua* Forst. f. On leaves. Herb. No. 759. Hokianga (Auckland), *E. B. Levy!* 24 Feb., 1921. Sandhills, Levin (Wellington), 16 m., *E. H. Atkinson! G. H. C.* 12 Oct., 1922. (Type.)

The host is endemic, and is abundant throughout. (Cheeseman, 1906, p. 893.)

The rust is characterized by the conspicuous reddish-brown sori, closely and finely echinulate epispore, and numerous scattered, conspicuous, papillate germ-pores.

4. Uredo Scirpi-nodosi McAlpine. (Fig. 116.) Cyperaceae.

McAlp., *Rusts Aus.*, p. 202, 1906.

II. Uredosori caulicolous, scattered or crowded, elliptical, up to 2 mm. long, cinnamon-brown, bullate, pulverulent, becoming exposed by the longitudinal fissuring of the epidermis. Spores elliptical, obovate, or subglobose, 25–35 × 20–25 mmm.; epispore tinted cinnamon-brown, coarsely and sparsely echinulate, 2–2·5 mmm. thick, cell-contents granular, cinnamon-brown; germ-pores equatorial, 2, conspicuous.

Host: *Scirpus inundatus* Poir. On stems. Herb. Nos. 282, 325. Seashore (Wellington), *E. H. Atkinson!* 17 April, 1920; 27 Jan., 1921. Bog, Tiritea, Palmerston North (Wellington), 300 m., *G. H. C.* 4 March, 1921. Seashore, Bluff (Southland) *W. D. Reid!* 26 May, 1922.

Distribution: Victoria.

The host is indigenous, and is widespread, occurring in marshy localities from sea-level to 1,000 m.; it occurs also in Australia, Malay Archipelago, and temperate South America. (Cheeseman, 1906, p. 775.)

The rust forms conspicuous bullate sori on the stems; these are usually severely infected with *Darluca filum* Cast. Characterized by the thick coloured epispore, and the two equatorial conspicuous germ-pores.

5. Uredo Dianellae Dietel. (Fig. 117.) Liliaceae.

Diet., *Hedw.*, vol. 37, p. 213, 1898.

Not *Uredo Dianellae* Rac., *Parasit. Algen & Pilze Javas*, vol. 2, p. 33, 1900.

II. Uredosori hypophyllous, seated on reddish-purple spots which are visible on the upper surface, scattered, elliptical, 1 mm. long, or confluent and up to 5 mm. long, pulverulent, pallid brown, bullate, surrounded by the ruptured epidermis. Spores subglobose or broadly elliptical, 16–22 mmm. diam.; epispore hyaline, densely and finely echinulate, 1·5 mmm. thick, cell-contents granular, yellow; germ-pores scattered, numerous (6–8), obscure.

Host: *Dianella intermedia* Endl. On leaves. Herb. No. 762. Horahora Rapids, Waikato River (Auckland), *E. H. Atkinson!* 26 March, 1921.

Distribution: Java; Ceylon; Hong-Kong.

The host is indigenous, and is widespread; it occurs also in Norfolk Island and Polynesia. (Cheeseman, 1906, p. 715.)

Characterized by the small spores, densely and finely echinulate hyaline epispore, and numerous scattered, obscure germ-pores.

Although this form does not agree in all particulars with the description published by Dietel, it resembles it too closely to allow of its being separated as a distinct species. It agrees in most particulars with *U. Dianellae* Rac., so that this form is better classed as a synonym.

6. Uredo Phormii n. form-sp. (Fig. 118.)

II. Uredosori hypophyllous, seated on discoloured spots visible on the upper surface, scattered or more commonly crowded into irregular groups often covering the entire under-surface of the leaf, elliptical, 1 mm. long, or confluent and up to 6 mm. long, ferruginous, bullate, pulverulent, surrounded and partially covered by the ruptured epidermis. Spores obovate, elliptical, or subglobose, 21–30 × 17–22 mmm.; epispore golden-brown, coarsely and sparsely echinulate, 2·5–3 mmm. thick, cell-contents brown, granular; germ-pores scattered, 3–5, commonly 3, conspicuous.

Hosts :—

Phormium tenax Forst. On leaves. Herb. Nos. 755, 775. Plimmerton (Wellington), 20 m., *R. Waters! H. Drake! G. H. C.* 16 Jan., 1922. (Type.)

Phormium Colensoi Hook. f. Herb. No. 757. Tokaanu–Waiouru Road, Taupo, 800 m., *E. H. Atkinson!* 11 March, 1922.

Both hosts are indigenous, the former being common throughout, and extending to Norfolk Island, whilst the latter is endemic. (Cheeseman, 1906, p. 716.)

This rust is characterized by the small spores, coloured coarsely and sparsely echinulate thick epispore, and conspicuous scattered germ-pores. Severely infected leaves are useless for milling purposes.

7. **Uredo Rhagodiae** Cooke and Massee. (Fig. 119.) Chenopodiaceae.

Cke. et Mass., *Grev.*, vol. 15, p. 99, 1887.

II. Uredosori amphigenous, chiefly hypophyllous, scattered, bullate, reddish-brown, orbicular, 1–1·5 mm. diam., long covered, at length free and surrounded by the ruptured epidermis. Spores globose or obovate, 22 30 × 20–23 mmm. ; epispore cinnamon-brown, sparsely and moderately echinulate, 2–2·5 mmm. thick, cell-contents granular, cinnamon-brown ; germ-pores scattered, numerous (8–10), conspicuous.

Host : *Rhagodia nutans* R. Br. On leaves. Herb. No. 294. Seashore, Seatoun (Wellington), *E. H. Atkinson! G. H. C.* 27 Jan., 1921.

Distribution : Victoria.

The host is indigenous, and is not uncommon on rocky areas near the sea-coast ; it occurs also in eastern Australia. (Cheeseman, 1906, p. 578.)

The spore-measurements (20 × 15 mmm.) given by Cooke and Massee are much too small, as has been ascertained by McAlpine (1906, p. 207) from an examination of part of the type material.

8. **Uredo inflata** Cooke. (Fig. 120.) Umbelliferae.

Cke., *Grev.*, vol. 19, p. 48, 1890.

II. Uredosori amphigenous, crowded or scattered, seldom confluent, irregular in shape, usually elliptical when up to 4 mm. long, bullate, pallid ferruginous, long covered by the epidermis. Spores globose or shortly elliptical, 25–35 × 22–32 mmm. ; epispore hyaline, minutely and densely verruculose (appearing smooth when wet), up to 6 mmm. thick, slightly thickened at the apex (2–3 mmm.), cell-contents granular, tinted cinnamon ; pedicel persistent, hyaline, fragile, up to 25 × 5 mmm. ; germ-pores indistinct.

Host : *Anisotome latifolia* Hook. f. (= *Ligusticum latifolium* Hook. f.). On leaves. Herb. No. 41. Campbell Islands, *T. Kirk!* 1890. (Type collection.)

Distribution : Campbell Islands.

The host is endemic, and confined to the Campbell and Auckland Islands. (Cheeseman, 1906, p. 215.)

This species is characterized by the almost smooth thick and hyaline episporè. This may prove to be a species of *Uromyces*, but this can be verified only by germinating the spores, and as the material at hand is too old (all attempts to germinate the spores having failed) it is retained here for the present.

9. **Uredo Oleariae** Cooke. (Fig. 125.) Compositae.

Cke., *Grev.*, vol. 19, p. 48, 1890.

II. Uredosori hypophyllous, seated on discoloured spots visible on the upper surface, orbicular, 1 mm. diam., pulverulent, reddish-brown, deeply seated in the dense tomentum clothing the leaf-surface. Spores subglobose, elliptical, or obovate, 42–55 × 35–40 mmm.; epispore hyaline, coarsely and sparsely echinulate, varying in thickness from 3 to 6 mmm., cell-contents granular, tinted ferruginous; germ-pores indistinct.

Host: *Olearia Lyallii* Hook. f. On leaves. Herb. No. 42. Port Ross (Auckland Islands), *T. Kirk!* 1890. (Type collection.)

Distribution: Auckland Islands.

The host is endemic, and is confined to the Auckland Islands and the Snares. (Cheeseman, 1906, p. 283.)

The published description of Cooke's is far from accurate, as the spores are stated to be 22 × 15 mmm., and the epispore to be smooth. Fortunately I have part of the type collection, and the above description has been drawn up from this. The epispore in different spores varies in thickness, and when mounted and examined in the usual manner is seen to be very irregular; when the spores are boiled for a few seconds in lactic acid the outer covering swells somewhat and a distinct inner wall becomes visible (fig. 125, *a*). The large size of the spores, together with the thick coarsely-echinulate epispore, serve to characterize the species.

10. **Uredo southlandicus** n. form-sp. (Text-fig. 122, and Plate 2, fig. 6.)

II. Uredosori epiphyllous, scattered evenly over the leaf-surface, orbicular, 1–2 mm. diam., bullate, golden-brown, long covered. Spores subglobose or elliptical, 28–35 × 24–28 mmm.; epispore hyaline, coarsely and sparsely echinulate, 4–5 mmm. thick, cell-contents granular, orange; germ-pores indistinct.

Host: *Olearia angustifolia* Hook. f. On leaves. Herb. No. 753. Stewart Island, *T. Kirk!* Jan., 1882. Sea-level, Bluff (Southland), *L. Cockayne!* 26 May, 1922. (Type.)

The host is endemic, and is confined to the southern part of the South Island and to Stewart Island. (Cheeseman, 1906, p. 281.)

This species is characterized by the thick, coarsely and sparsely echinulate epispore, and by the epiphyllous covered sori.

11. **Uredo tupare** n. form-sp. (Fig. 123.)

II. Uredosori hypophyllous, scattered, seated on pallid spots visible on the upper surface, orbicular, 1 mm. diam., orange, fading with age to pallid yellow, pulverulent, deeply seated in the dense tomentum of the leaf. Spores obovate or elliptical, 40–55 × 25–31 mmm.; epispore hyaline, closely and finely echinulate, 1·5–2 mmm., cell-contents granular, yellow; germ-pores scattered, numerous (6–8), obscure.

Host: *Olearia Colensoi* Hook. f. On leaves. Herb. Nos. 758, 773. Mount Waiopehu (Wellington), 1,700 m., *G. H. C.* 26 October, 1919. (Type.) Table-top, Mount Hector (Wellington), 1,120 m., *E. H. Atkinson!* 6 Feb., 1921. Mount Dennan (Wellington), 1,000 m., *E. H. Atkinson!* 7 Jan., 1922.

The host is endemic, and widely spread throughout the mountain areas. (Cheeseman, 1906, p. 282.)

The large-sized spores and closely and finely echinulate epispore characterize this species.

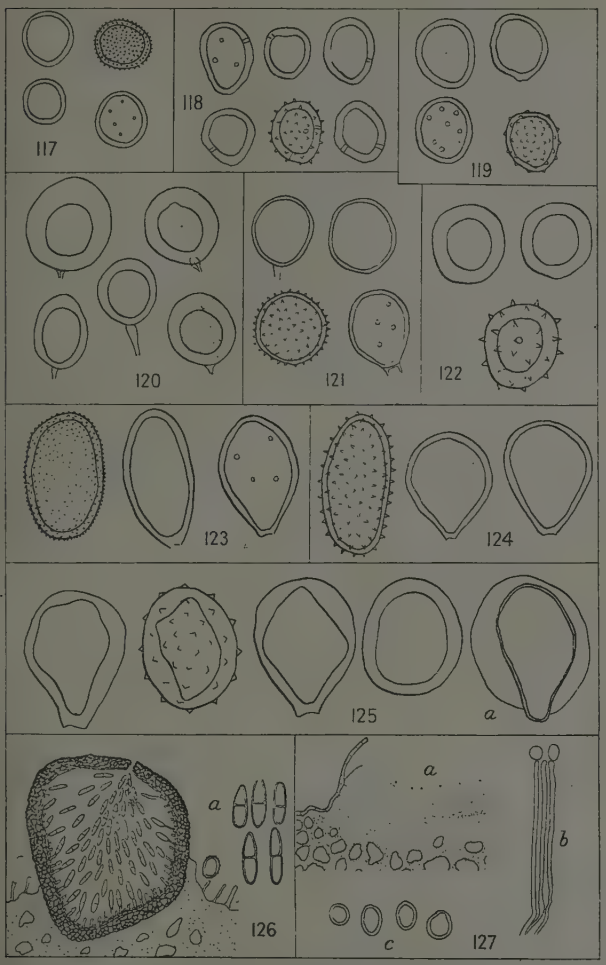


FIG. 117.—*Uredo Dianellae* Diet. Uredospores from *Dianella intermedia* Endl.
FIG. 118.—*Uredo Phormii* G. H. Cunn. Uredospores from *Phormium tenax* Forst.
FIG. 119.—*Uredo Rhagodiae* Cke. et Mass. Uredospores from *Rhagodia nutans* R. Br.
FIG. 120.—*Uredo inflata* Cke. Uredospores from *Anisotome latifolia* Hook. f.
FIG. 121.—*Puccinia Celmisiae* G. H. Cunn. Uredospores from *Celmisia longifolia* Cass.
FIG. 122.—*Uredo southlandicus* G. H. Cunn. Uredospores from *Olearia angustifolia* Hook. f.
FIG. 123.—*Uredo tupare* G. H. Cunn. Uredospores from *Olaeria Colensoi* Hook. f.
FIG. 124.—*Uredo wharanui* G. H. Cunn. Uredospores from *Olearia insignis* Hook. f.
FIG. 125.—*Uredo Oleariae* Cke. Uredospores from *Olearia Lyallii* Hook. f. The spore on the right has been boiled for a few seconds in lactic-acid solution. Note inner wall.
FIG. 126.—*Darluca Filum* Cast. Pycnidia and conidia from the uredosori of *Puccinia Juncophila* Cke. et Mass. on *Juncus vaginatus* R. Br. Pycnidia × 200; conidia × 480.
FIG. 127.—*Tuberculina persicina* Sacc. on *Aecidium otagense* Linds., from *Clematis Colensoi* Hook. f. (*a*) Part of a sporodochium, × 24; (*b*) conidiophores, × 300; (*c*) conidia, × 400.

All figures × 400, with the exception of figs. 126 and 127.

12. **Uredo wharanui** n. form-sp. (Fig. 124.)

II. Uredosori hypophyllous, seated on pallid spots visible on the upper surface, orbicular, 1 mm. diam., bullate, reddish-orange, pulverulent, deeply buried in the dense tomentum of the leaf-surface. Spores elliptical or obovate, 35–55 × 26–34 mmm. ; epispore hyaline, coarsely and moderately echinulate, 2–2·5 mmm., thick, cell-contents granular, reddish-orange ; germ-pores indistinct.

Host : *Olearia insignis* Hook. f. On leaves. Herb. No. 778. Woodside Creek, Wharanui (Marlborough), *E. H. Atkinson !* 3 Nov., 1922.

The host is endemic, and is confined to the Marlborough District. (Cheeseman, 1906, p. 279.) In size and shape the spores of this species resemble the preceding ; it is separated on account of the thicker, coarsely and moderately echinulate epispore, and bright reddish-orange colour of the sori.

The following species and form-species have been recorded as occurring in New Zealand, but, as I have not seen specimens, I am unable to give descriptions ; moreover, as in most instances the published descriptions are so fragmentary as to be useless for comparative purposes, I have not included them here.

(*a.*) *Uromyces Azorellae* Cke., *Grev.*, vol. 10, p. 2, 1890.

Host : *Azorella trifoliata* Benth. et Hook. f. (*Pozoa trifoliata* Hook. f.). Collected in Hawke's Bay by Colenso.

(*b.*) *Uromcyes citriformis* Berk., *Fl. N.Z.*, vol. 2, p. 210, 1855.

Host : " On leaves of some orchid, apparently a *Thelymitra*."

U. citriformis Bab. (*Hdbk. Fl. N.Z.*, p. 625, 1864) is an error of compilation. Mr. Mason, Imperial Bureau of Mycology, Kew, states that there are no specimens of this species at Kew or the British Museum. As no specimens are known, and as the description is too imperfect for determination, and as the host also is unknown, it would be advisable to discard this name.

(*c.*) *Uromyces scariosus* Berk., *Fl. N.Z.*, vol. 2, p. 195, 1855.

Hosts : *Geranium dissectum* L. and *G. microphyllum* Hook. f. (= *Geranium potentilloides* Hook. f.

Collected in Hawke's Bay by Colenso.

(*d.*) *Puccinia novo-zelandica* Bubak, *Sitz-ber. Boehm. Ges. Wiss.*, p. 5, 1901. *P. compacta* Berk., *Fl. N.Z.*, vol. 2, p. 195, 1855.

Host : *Myosotis capitata* Hook. f.

These specimens were said to have been collected in the South Island, but the host is confined to the Auckland and Campbell Islands. (Cheeseman, 1906, p. 463.)

(*e.*) *Aecidium Anisotomes* Reich., *Ardt. Sitzungber. K. Akad. der Wissensch.*, p. 3, 1865.

Host : *Angelica geniculata* Hook. f.

Possibly *Puccinia cuniculi* G. H. Cunn., although the description does not agree with that of the aecidium of this host.

(*f.*) *Aecidium dissimenatum* Berk., *Hdbk. Fl. N.Z.*, p. 756, 1867.

Host: *Hypericum japonicum* Thunb.

McAlpine (1906, p. 200) records this rust as occurring in Australia on the same host.

(*g.*) *Aecidium monocystis* Berk., *Fl. N.Z.*, vol. 2, p. 196, 1855.

Host: *Phyllachne Colensoi* Berggr. (= *Helophyllum Colensoi* Hook. f.).

McAlpine (1906, p. 197) states that this is common on *Abrotanella forsterioides* Hook. f. in the vicinity of Hobart, and doubts the determination of the host as given above; he claims that it is scarcely likely that the same species would occur on hosts belonging to the Compositae and Candolleaceae (= Stylidieae). Mr. Rodway, Government Botanist, Hobart, has written to me to the same effect; he believes that the species was in error stated to have been collected in New Zealand, and was really collected in Tasmania. Although *Abrotanella* occurs in New Zealand, all the species are endemic; so that the matter must remain at issue until the original host is correctly determined.

(*h.*) *Uredo Acaciae* Cke., *Grev.*, vol. 19, p. 3, 1890.

Host: *Acacia* sp.

The description is too incomplete for determination, but it will doubtless prove to be a species of *Uromycladium*.

(*i.*) *Uredo antarctica* Berk., *Fl. Antarct.*, p. 176, 1847.

Host: *Luzula crinita* Hook. f. The host is confined to the Auckland and Campbell Islands.

(*j.*) *Aecidium Discariae* Cke., *Grev.*, vol. 14, p. 89, 1886.

This form belongs to the cycle of *Uromyces Discariae* G. H. Cunn.

APPENDIX: FUNGI PARASITIC UPON THE UREDINALES.

In the past numerous fungi belonging to the following genera have been recorded as parasitizing the various spore-forms of the *Uredinales*:—

Phycomycetes: *Olpidium* (= *Olipidiella*).

Ascomycetes: *Mycosphaerella* (= *Sphaerella*).

Fungi Imperfecti: Sphaeropsidales—*Phyllosticta*; *Ascochyta*; *Darluca*.

Hyphomycetes—*Cladosporium*; *Fusarium*; *Fusoma*; *Macrosporium*; *Oospora*; *Ramularia*; *Tuberculina*.

Doubtless many of these will later prove to be merely saprophytic, their contiguity with a rust upon the same host-plant leading to the belief that they were parasitic upon the rust.

So far only the two species described below have been collected in New Zealand; *Darluca* is exceedingly common, especially on the uredosori of many of our rusts, but *Tuberculina* has been collected once only. Both species are included under the Fungi Imperfecti, the former belonging to the Sphaeropsidales (Sphaerioidaceae-Hyalodidymae), the latter to the Hyphomycetes (Tuberculariaceae-Amerosporae).

DARLUCA Castagne.

Cast., *Cat. Pl. Mus. Suppl.*, p. 53, 1851.

Pycnidia free, superficial, depressed, or conico-globose, obsoletely papillate, ostiolate, black; context of closely-woven thick-walled coloured hyphae. Spores (conidia) 1-septate, hyaline, elliptic-oblong or fusoid, muticate; borne singly on simple unbranched pedicels.

Habitat: Parasitic upon the spermogones, aecidia, uredosori, and teleutosori of numerous Uredinales; saprophytic upon the leaves of deciduous plants.

Distribution: Europe; North and South America; Africa; Ceylon; Japan; Australia.

Although eight species have been described, only one has been collected here. It is probable that many of these so-called species are but variable forms of *D. Filum*, as in many instances they appear to have been erected on slight differences in the size of the spores, a character too variable to be considered specific; for, as is shown below, in *D. Filum* alone the spores on different hosts range in length from 10 to 18 mmm.; furthermore, this variation may be seen in the spores from a single pycnidium.

1. **Darluca Filum** Castagne. (Text-fig. 126, and Plate 2, fig. 5.)
Uredinales.

Cast., *l.c.*

Sphaeria Filum Biv.-Bern., *Bernh. Stirp. rar Sic. Manip.*, vol. 3, p. 12, 1815. *Phoma Filum* Fr., *Syst. Myc.*, vol. 2, p. 547, 1823.

Pycnidia superficial or immersed, scattered or gregarious, conico-globose, elliptical, obovate, or depressed-globose, 90–120 × 60–100 mmm. diam., ostiolate, smooth, black. Conidia 1-septate, hyaline, fusoid, smooth, 10-18 × 3–6 mmm., slightly or not constricted at the septum, muticate.

Habitat: Parasitic upon the spores of the following species: *Uromyces otakou* G. H. Cunn. (II); *U. Polygoni* Fcl. (II); *Uromycladium alpinum* McAlp. (II); *Urom. notabile* McAlp. (II); *Urom. Tepperianum* (Sacc.) McAlp. (III); *Puccinia Caricis* Schroet. (II, III); *P. Chrysanthemi* Roze (II); *P. Coprosmae* Cke. (III); *P. Elymi* Westnd. (II); *P. Hoheriae* Wakef. (III); *P. Hydrocotyles* Cke. (II); *P. juncophila* Cke. et Mass. (II); *P. Morrisoni* McAlp. (II); *P. Plagianthi* McAlp. (III); *P. Poarum* Niels. (II); *P. pulverulenta* Grev. (II); *P. punctata* Link. (II); *P. whakatipu* G. H. Cunn. (II); *P. Unciniarum* Diet. et Neg. (II, III); *Phragmidium novae-zelandiae* G. H. Cunn. (I); *Phr. Potentillae* P. Karst. (I, II);

PLATE 1.

FIG. 1.—*Phragmidium Acaenae* G. H. Cunn. Caeomata and teleutosori from *Acaena microphylla* Hook. f. Arrows point to the minute teleutosori.

FIG. 2.—*Phragmidium novae-zelandiae* G. H. Cunn. Teleutosori from *Acaena novae-zelandiae* T. Kirk.

FIG. 3.—*Phragmidium Potentillae* P. Karst. Teleutosori on *Acaena Sanguisorbae* Vahl.

FIG. 4.—*Hamaspora acutissima* Syd. Teleutosori on *Rubus australis* Forst. f. Note the long and much-entwined fibrils. Arrow points to sori from which the fibrils have disappeared.

FIG. 5.—*Milesina Histiopteridis* G. H. Cunn. Uredosori on *Histiopteris incisa* (Thunb.) J. Sm. The white spots consist of numerous uredospores which have exuded from the immersed peridia.

FIG. 6.—*Melampsora Lini* Desmaz. Teleutosori on *Linum monogynum* Forst.

FIG. 7.—*Aecidium Milleri* G. H. Cunn. on *Aristotelia serrata* (Forst.) Oliver.

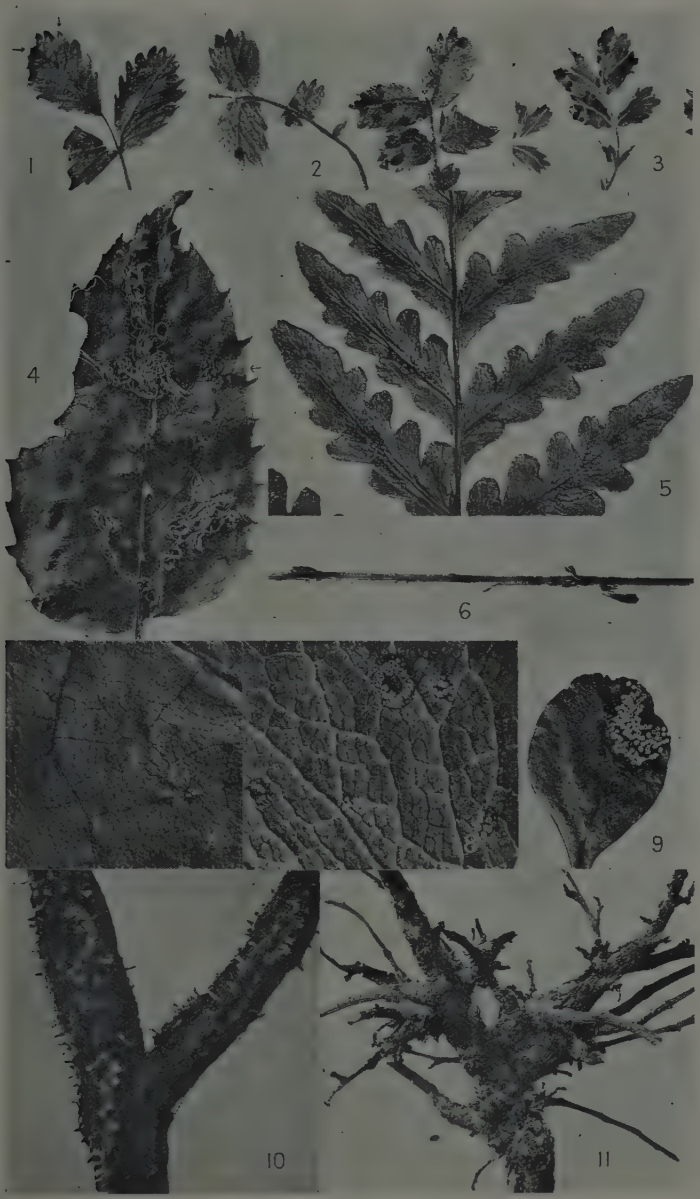
FIG. 8.—*Aecidium Ranunculacearum* DC. on *Ranunculus Lyallii* Hook. f.

FIG. 9.—*Aecidium hupiro* G. H. Cunn. on *Coprosma foetidissima* Forst.

FIG. 10.—*Aecidium kowhai* G. H. Cunn. on *Edwardsia tetraptera* (J. Mill.) Oliver. Photo by E. Bruce Levy.

FIG. 11.—*Aecidium Myoporı* G. H. Cunn. on *Myoporum laetum* Forst. f.

Natural size. All photographs, with the exception of fig. 10, by the writer.



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Aecidium otagense Linds.; *A. Ranunculacearum* DC.; *Uredo Dianellae* Diet.; *U. karetu* G. H. Cunn.; *U. Phormii* G. H. Cunn.; *U. Scirpi-nodosi* McAlp.; *U. toetoe* G. H. Cunn.

Distribution: Europe; North and South America; Ceylon; Japan; Africa; Australia.

From the foregoing it will be seen that in New Zealand this species has been collected on aecidia, caeomata, uredosori, and teleutosori.

The mycelium ramifies through the sori and appears to plasmolyze and disintegrate those spores with which the hyphae come in contact; in certain sori, indeed, it is difficult to obtain any unaffected spores. Generally the pycnidia are superficial and easily seen, but in certain cases, particularly when they are parasitic upon aecidia, they are almost competely immersed, and their presence noted only when sections of the aecidia are examined. Saccardo (*Syll. Fung.*, vol. 3, p. 410, 1884) states that the spores have on either end a few fine bristles; I have failed to observe these, although I have examined numerous microtome sections of pycnidia of all ages. So common are the pycnidia on certain species that they have frequently been mistaken for spermogones, and described as such.

TUBERCULINA Saccardo.

Sacc., *Mich.*, vol. 2, p. 34, 1880.

Uredinula Speg., *Anal. Soc. Cientif. Argent.*, p. 213, 1880. *Cordalia* Gobi, *Mem. Acad. Imp. Sci. St. Petersburg*, vol. 32, p. 13, 1885.

Sporodochia plane or flattened-discoid, pulverulent, formed of closely compacted upright conidiophores, which are simple and unbranched. Spores (conidia) innate, unicellular, hyaline, smooth, subglobose.

Habitat: Parasitic upon the aecidia, uredosori, and teleutosori of Uredinales.

PLATE 2.

FIG. 1.—*Aecidium Macrodontae* G. H. Cunn. on *Olearia macrodonta* Baker.

FIG. 2.—*Aecidium Celmisiae-discoloris* G. H. Cunn. on *Celmisia discolor* Hook. f.

FIG. 3.—*Aecidium Celmisiae-petiolatae* G. H. Cunn. on *Celmisia petiolata* Hook. f. The aecidia are covered by the tomentum of the leaf, and in the photograph appear as slightly-raised linear blisters, principally to the right of the midrib.

FIG. 4.—*Aecidium Celmisiae-Petriei* G. H. Cunn. on *Celmisia Petriei* Cheesem. On the right of the midrib the groups of aecidia are covered by the tomentum, on the left the tomentum has been stripped off and the distorted peridia and spore-masses exposed.

FIG. 5.—*Darluca Filum* Cast. on *Uredo Scirpi-nodosi* McAlp. Uredosori on the left, parasitized sori on the right.

FIG. 6.—*Uredo southlandicus* G. H. Cunn. on *Olearia angustifolia* Hook. f. Note the characteristic epiphyllous, bullate, scattered sori.

FIG. 7.—*Puccinia namua* G. H. Cunn. Aecidia on *Anisotome filifolia* (Hook. f.) Cockayne and Laing.

FIG. 8.—*Tuberculina persicina* Sacc. on *Aecidium otagense* Linds. Note the flattened sporodochia surrounded by the ruptured epidermis.

FIG. 9.—*Coleosporium Fuchsiae* Cke. Uredosori on leaves of seedlings of *Fuchsia excorticata* (Forst. f.) L. f.

Natural size. Photographs by the writer. All photographs are taken from dried herbarium material.

Distribution: Europe; South America.

Although twenty species have been described, I doubt whether more than a third of this number are valid, as, judging from the published descriptions, most appear to have been separated on host-distinctions alone.

1. Tuberculina persicina Saccardo. (Text-fig. 127, and Plate 2, fig. 8.)

Sacc., *Fung. Ital.*, tab. 964, 1881.

Tuberculariа persicina Ditm., *Sturm. Deutsch. Fl.*, vol. 1, p. 99, 1817. *Caeoma fallax* Cda., *Icon.*, vol. 5, p. 49, 1842. *Uredo lilicina* Rob., in Desm., *Ann. Sci. Nat.*, ser. 8, vol. 3, p. 11, 1847. *Cordalia persicina* Gobi, *Mem. Acad. Sci. Imp. St. Petersburg*, vol. 32, p. 18, 1885.

Sporodochia discoid, 0·1–1·25 mm. diam., immersed, surface alone showing, pulverulent, consisting of closely compacted tinted hyphae, 25–80 mmm. long, 2–5 mmm. thick. Conidia unicellular, globose, or shortly elliptical, 7–14 mmm. diam., epispore smooth, tinted dingy-violet or violet-brown, 1 mmm. thick.

Habitat: Parasitic upon *Aecidium otagense* Linds. on *Clematis Colensoi* Hook. f. Miramar (Wellington), 20 m., *J. W. Bird!* 5 Nov., 1920.

Distribution: Europe.

This fungus is conspicuous owing to the powdery nature of the spore-masses, and the purple colour of the spores and sporodochia. These are plano-discoid in shape, and are surrounded by the ruptured epidermis and partly disintegrated peridia of the aecidia; the conidiophores are closely packed together, and somewhat resemble the hymenium of *Stereum* or some similar Basidiomycete. On their apices are borne the spores, which, owing to the method of production, frequently occur in chains.

In the specimens at hand the parasite is seen frequently to infect the aecidia before they appear on the surface—*i.e.*, before they dehisce—as when sections are examined aecidia in different stages of development may be seen in all stages of infection. But by far the greater number of parasitized aecidia appear to have been infected after they have expanded, since the sporidochia of the parasite are frequently seen to be partially surrounded by portions of the revolute margins, which give a very ragged appearance to the shoots of *Clematis* upon which the aecidia are located.

Considerable confusion has arisen in the past as to the systematic position of *Tuberculina*, and in many systematic papers it has been placed under the Ustilaginaceae; in fact, certain authors state that on germination the spores give rise to promycelia [basidia] bearing sickle-shaped conidia [basidiospores]. This is not the case, however, for I have germinated the spores and find they produce long and slender hyphae.

I have little doubt but that the so-called aecidium described and figured by Plowright (1899, p. 161) as occurring in the cycle of *Puccinia Vincae* Berk. is this species. He states that the spores are finely echinulate; but Grove (1913, p. 177), in a discussion of this so-called aecidium, states that they are smooth. Grove states that the organism in question is not an aecidum, and suggests that it may be a parasite; his description agrees closely with *T. persicina*, differing only in colour, which is stated to be dark-brown with a greyish bloom. Grove also mentions that both Sydow (1904, p. 338) and Fischer (1904, p. 167) considered the sporidochia on *Puccinia Vincae* to be primary uredosori.

It is worthy of mention that the larva of a dipterous insect, *Cecidomyia uredinicola*, also parasitizes the spores of many of our species of *Uromyces*, *Puccinia*, &c. The larva is about 3 mm. in length, and is conspicuous on account of its bright reddish-orange colour. It feeds only on the spores.

LATIN DIAGNOSES OF NEW SPECIES AND FORM-SPECIES.

The following diagnoses are arranged in order of genera as they appear in this paper, but the species under each genus are arranged in alphabetical order.

1. Phragmidium Acaenae sp. nov. (Fig. 93.) Rosaceae.

0. Spermagoniis amphigenis, sparsis, raris, conicis, subflavis.

I. Caeomatiis hypophyllis, raris, rotundis, 0·5–1 mm. latis, vel ellipticis et 3 mm. longis, pulvinatis, pulverulentibus, flavis; hyalino, clavatis paraphysis cinctis. Caeomatosporis globosis, obovatis, vel ellipticis, 18–28 × 16–29 mmm.; episporio hyalino, minute tenuiter echinulato, 1–1·5 mmm. crasso, contentu flavo, vacuolato.

III. Soris teleutosporiferis hypophyllis, caulicolis, sparsis, raris, rotundis, 0·1–0·5 mm. latis, primum compactis et pulvinatis, demum pulverulentibus, splendidis-nigris, nudis, soris cum paucis sporis. Teleutosporis 4–7-cellulo, communiter 6, longis-cylindricis, 50–95 × 20–25 mmm.; apice rustice acuminato, vel rotundato, leniter ad non incrassato, saepe papillato hyalino, ad 10 mmm. longis, basi rotundato, apice et basi saepe necne attenuatis; ad septa leniter necne constrictis; episporio castaneo, 3–4 mmm. crasso, raro hyalino verrucoso; pedicello persistente, hyalino apice tincto, fistuloso, ad 50 mmm. longo, 5–9 mmm. crasso, ad basim 20 mmm. inflato, verruculoso, foramine germinis ad cellulo 2–3, conspicuo.

Hab.: In foliis vivis et petiolibus *Acaenae microphyllae* Hook. f. Horto Botanico, Gore, Southland, New Zealand. *E. B. Levy.*

2. Phragmidium novae-zelandiae sp. nov. (Fig. 92.)

0. Spermagoniis *Phr. Acaenae* similibus.

I. Caeomatiis *Phr. Acaenae* similibus.

III. Soris teleutosporiferis hypophyllis, sparsis, ellipticis ad 3 mm. longis, pulvinatis, primum pulverulentibus, demum in solide catervis conglutinaris, pallidis glauco-nigris, nudis, sporis numerosis in soris. Teleutosporis 4–8-cellulo, communiter 6–7, oblongis-cylindricis, 65–118 × 18–24 mmm.; apice acuminato, raro rotundato, leniter necne crassato, in papillo apice cellulo episporio continuato, tincto, in summa hyalino, 8 mmm. longo, basi rotundato vel leviter attenuato; ad septa non constrictis; episporio fusco-nigris, 4–6 mmm. crasso, rustice solide verrucoso; pedicello persistente, hyalino apice tincto, ad 100 mmm. longo, 4–6 mmm. crasso, basim leniter necne inflato, verruculoso; foramine germinis ad cellulo 2–4, conspicuo.

Hab.: In foliis vivis *Acaenae novae-zelandiae* T. Kirk. Queenstown, Otago, New Zealand. *W. D. Reid.*

3. Phragmidium subsimile sp. nov. (Fig. 90.)

0. Spermagoniis hypophyllis, sparsis, raris, flavidulis.

I. Caeomatiis hypophyllis, sparsis, raris, rotundis, ad 0·5–3 mm. latis, pulverulentibus, flavis; paraphysibus hyalinis incurvatis clavatis cinctis. Caeomatosporis subglobosis, 18–22 mmm. latis; episporio hyalino, solide tenuiter verrucoso, 1·5–2 mmm. crasso, contentu vacuolato, luteo.

III. Soris teleutosporiferis hypophyllis, raris, ellipticis, ad 2 mm. longis, pulverulentibus, glauco-nigris, in soris sporis numerosis. Teleutosporis 5–7-cellulo, communiter 6, oblongo-teretis, 57–70 × 22–30 mmm.; apice rotundato, non incrassato, saepe prominente tincto papilloso coronato, ad 10 mmm. longis, basi rotundato, basi vel apice fortiter attenuato; ad septa non constrictis; episporio castaneo, 3–5 mmm. crasso, sparse rusticeque verrucoso; pedicello persistente, hyalino, apice tincto, crasso, ad 100 mmm. longis, 6-10 mmm. crasso, fistuloso, basi 18 mmm. inflato, verruculoso; foramine germinis ad cellulo 2–3, obscuro.

Hab.: In foliis vivis *Acaenae Sanguisorbae* Vahl. et *A. Sanguisorbae* Vahl. var. *pilosae* T. Kirk. Queenstown, Otago, New Zealand, 650 m. *W. D. Reid.*

4. Milesina Histiopteridis sp. nov. (Fig. 101.) Polypodiaceae.

II. Uredosoris hypophyllis. raris vel in linearis catervis, intercostalibus, ad 15 mm. longis, in masculis inaequalis discoloratis. 0·25–0·5 mm. latis, rotundis, bullatis, epidermide tectis, apicale aperto. Peridiis plano-globosis, ostiolatis, obovatis hyalinarum cellularum compositis, cellulo exteriore solide verruculoso. Uredosporis obovatis, ellipticis vel polygoniis, 18–26 × 14–18 mmm.; episporio hyalino, tenuiter verruculoso, 0·75 – 1 mmm. crasso, contentu hyalino, vacuolato; foraminis germinis obscuro.

III. Incognitis.

Hab.: In foliis vivis *Histiopteridis incisae* (Thunb.) J. Sm. Kelburn Wellington, New Zealand. *E. H. Atkinson, G. H. C.*

5. Aecidium Celmisiae-discoloris forma sp. nov. (Fig. 111.) Compositae.

0. Spermagoniis raris, sparsis, epiphyllis, immersis.

I. Aecidiis amphigeniis, praecipue epiphyllis, flavis, raris vel parvis catervis. Peridiis cylindricis, erumpentibus, super superficiem exstitis ad 1 mm., 0·1 mm. latis, marginibus incurvatis, primum dentatis demum profunde laceratis, albis. Aecidiosporis subglobosis, ellipticis vel obovatis, 36–42 × 28–34 mmm.; episporio hyalino, solide deciduis tuberculis tecto 3 mmm. crasso, contentu flavido, granuloso.

Hab.: In foliis vivis *Celmisiae discoloris* Hook. f., *C. Sinclairii* Hook. f., et *C. prorepentis* Petrie. Tooth Peaks, Otago, New Zealand. *W. D. Reid.*

6. Aecidium Celmisiae-petiolatae forma sp. nov. (Fig. 110.)

0. Incognitis.

I. Aecidiis hypophyllis, in maculis discoloris, raris vel parvis catervis, flavis. Peridiis plano-globosis, 0·25 mm. latis, immersis, marginibus incurvatis, hyalinis, tomento denso folii tectis. Aecidiosporis polygoniis,

ellipticis vel obovatis, 27–45 × 20–26 mmm.; episporio hyalino, solide subtiliter verruculoso, 1–1·5 mmm. crasso, contentu granuloso, luteo.

Hab.: In foliis vivis *Celmisiae petiolatae* Hook. f. Arthur's Pass, Canterbury, New Zealand, 1,000 m. · *E. H. Atkinson.*

7. **Aecidium Celmisiae-Petriei** forma sp. nov. (Fig. 112.)

0. Spermagoniis sparsis, raris.

I. Aecidiis hypophyllis, in linearibus catervis, in maculis discoloratis, et bullatis infra tomentum folii diu tectis. Peridiis cylindricis, 0·25 mm. latis, tomento premente distortis, marginibus incurvatis, profundis laceratis, albis. Aecidiosporis longis-ellipticis vel obovatis-ellipticis, 36–52 × 20–25 mmm.; episporio hyalino, cum solide deciduo tuberculo tecto, 2 mmm. crasso, contentu granuloso, luteo.

Hab.: In foliis vivis *Celmisiae Petriei* Cheeseman. Lake Harris track, Otago, New Zealand, 1,100 m. *W. D. Reid.*

8. **Aecidium hupiro** forma sp. nov. (Fig. 109.) Rubiaceae.

0. Spermagoniis amphigeniis, immersis, ad aecidiis immixtis.

I. Aecidiis hypophyllis, in catervis inaequalibus, in maculis discoloratis luteis. Peridiis erumpentibus, cylindricis, 1 mm. altis, 0·5 mm. latis, marginibus erectis, non revolutis, laceratis, luteis. Aecidiosporis polygoniis vel ellipticis, 42–50 × 34–40 mmm.; episporio hyalino, solide rustice verruculoso, 2–2·5 mmm. crasso, contentu rustice granuloso, luteo.

Hab.: In foliis vivis et petiolibusque *Coprosmae foetidissimae* Forst. Alpha Hut, Mount Hector, Wellington, New Zealand, 1,700 m. *H. Hamilton, J. G. Myers.*

9. **Aecidium kowhai** forma sp. nov. (Fig. 104.) Leguminosae.

0. Incognitis.

I. Aecidiis caulicolis, in catervis longis, in tumerosis fusiformibus, ad 7 cm. longis, magnis fastigiatis distortionibus factis luteis. Peridiis cupulatis, breviter erumpentibus, 0·25 mm. altis, 0·5 mm. latis, pateris subtiliter revolutus, laceratis demum erosis, tinctis luteis. Aecidiosporis polygoniis vel ellipticis, 27–32 × 18–21 mmm.; episporio hyalino, solide subtiliter verruculoso, 1 mmm. crasso, contentu granuloso, luteo.

Hab.: In caulibusque *Edwardsiae tetrapterae* (J. Mill.) Oliver. Brightwater, Nelson, New Zealand, 200 m. *C. Nash, W. C. Hyde, G. H. C.*

10. **Aecidium Macrodontae** forma sp. nov. (Fig. 108.) Compositae.

0. Spermagoniis amphigeniis, praecipue epiphyllis, sparsis, aecidiis immixtis.

I. Aecidiis hypophyllis et petiolicolis, in catervis inaequalibus, ad 10 mm. longis, in maculis discoloratis distortionibus, luteis. Peridiis immersis, 0·1–0·2 mm. latis, marginibus incurvatis, dentatis, albis. Aecidiosporis polygoniis ellipticis vel obovatis, 25–37 × 18–24 mmm.; episporio hyalino, solide rustice verruculoso, 1 mmm. crasso, contentu luteo, granuloso.

Hab.: In foliis vivis et petiolibusque *Oleariae macrodontae* Baker. The track, Clinton Valley, Otago, New Zealand. *E. H. Atkinson.*

11. **Aecidium Milleri** forma sp. nov. (Fig. 105.) Tiliaceae.

0. Incognitis.

I. Aecidiis hypophyllis, in catervis minutisque raris, 3–6 in catervis, in maculis pallidis, luteis. Peridiis cupulatis, erumpentibus, 0·25 mm. latis, marginibus erectis, non revolutis, subtiliter dentatis, albis. Aecidiosporis subglobosis vel polygoniis, 20–26 × 17–23 mmm.; episporio hyalino, solide subtiliter verruculoso, 1 mmm. crasso, contentu luteo, vacuolato.

Hab.: In foliis vivis *Aristoteliae serratae* (Forst.) Oliver. Pokaka, Waimarino County, New Zealand, 800 m. *D. Miller.*

12. **Aecidium Myopori** forma sp. nov. (Fig. 106.) Myoporaceae.

0. Incognitis.

I. Aecidiis caulicoliis, truncicoliis et petiolicolis, in locis inflatis fusiformibus, ad 15 cm. longis, in catervis linearibus, aurantiacis. Peridiis erumpentibus, cylindricis, super superficiem exstitis ad 4 mm., 1 mm. latis, marginibus subtiliter expansis non revolutis, profunde inaequalibus laceratis, tinctis aurantiacis, demum albis. Aecidiosporis obovatis, ellipticis, polygoniis, raro lacrimiformibus, 21–45 × 17–20 mmm.; episporio hyalino, subtiliter solide verruculoso, 1 mmm. crasso, contentu rubescente-luteo, foramine germinis obscuro.

Hab.: In caulibusque, trunci, et petiolibusque *Myopori laeti* Forst. f. Palmerston North, Wellington, New Zealand, 250 m. *G. H. C.*

13. **Uredo Crinitae** forma sp. nov. (Fig. 114.) Gramineae.

II. Soris uredosporiferis amphigeniis, in maculis discoloratis, raris, raro confluentibus, ellipticis, 1 mm. longis, rubescente-aurantiacis, pulverulentibus, rupta epidermide cinctis. Uredosporis globosis vel subglobosis, 38–41 mmm. latis; episporio hyalino, solide subtiliter echinulato, 1 mmm. crasso, contentu aurantiaco, granuloso; foraminibus germinis raris, numerosis (12–18), conspicuis; numerosis hyalinis, capitatis paraphysibus immixtis.

Hab.: In foliis vivis *Dichelachnidis crinitae* (Forst. f.) Hook. f. Akaroa, Banks Peninsula, Canterbury, New Zealand. *W. D. Reid.*

14. **Uredo karetu** forma sp. nov. (Fig. 115.)

II. Soris uredosporiferis hypophyllis, in maculis fuscis, linearibus, raro confluentibus, pulverulentibus, 1 mm. longis, luteo-aurantiacis, rupta epidermide cinctis. Uredosporis subglobosis vel obovatis, 34–45 × 30–35 mmm.; episporio pallido-luteo, leniter subtiliter echinulato, 2–2·5 mmm. crasso, contentu luteo, granuloso; foraminibus germinis raris, numerosis (8–12), obscuris.

Hab.: In foliis vivis *Hierochloidis redolentis* (Forst. f.) R. Br. Sea-level, Bluff, Southland, New Zealand. *W. D. Reid.*

15. **Uredo Phormii** forma sp. nov. (Fig. 118.) Liliaceae.

II. Soris uredosporiferis hypophyllis, in maculis discoloratis, raris vel in catervis irregularibus, ellipticis, 1 mm. longis, aut confluentibus vel 6 mm. longis, ferrugineis, bullatis, pulverulentibus, rupta epidermide cinctis et partim tectis. Uredosporis obovatis, ellipticis vel subglobosis, 21–30 × 17–22 mmm.; episporio flavo-brunneo, rustice raro echinulato, 2·5–3 mmm. crasso, contentu brunneo, granuloso; foraminibus germinis raris, 3–5, communiter 3, conspicuis.

Hab.: In foliis vivis *Phormii tenacis* Forst. et *P. Colensoi* Hook. f. Tokaanu–Waiouru Road, Taupo, New Zealand, 800 m. *E. H. Atkinson.*

16. **Uredo southlandicus** forma sp. nov. (Fig. 122.) Compositae.

II. Soris uredosporiferis epiphylli, raris, rotundatis, 1–2 mm. latis, bullatis, flavo-brunneis, tectis. Uredosporis subglobosis vel ellipticis, 28–35 × 24–28 mmm.; episporio hyalino, rustice raro echinulato, 4–5 mmm. crasso, contentu granuloso, aurantiaco; foramine germinis non conspicuo.

Hab.: In foliis vivis *Oleariae angustifoliae* Hook. f. Sea-level, Bluff, Southland, New Zealand. *L. Cockayne.*

17. **Uredo toetoe** forma sp. nov. (Fig. 113.) Gramineae.

II. Soris uredosporiferis hypophyllis, raris, in maculis discoloratis, ellipticis, 0·5–1 mm. latis, aut confluentibus ad 4 mm. longis, rubro-brunneis, subtiliter dense echinulato, 1·5 – 2 mmm. crasso, contentu granuloso, brunneis; foramine germinis raris, 7–12, conspicuo, papillato.

Hab.: In foliis vivis *Arundinis conspicuae* Forst. f. Sandhills, Levin, Wellington, New Zealand, 16 m. *E. H. Atkinson, G. H. C.*

18. **Uredo tupare** forma sp. nov. (Fig. 123.)

II. Soris uredosporiferis hypophyllis, raris, in maculis pallidis, rotundatis, 1 mm. latis, aurantiacis, pulverulentibus, diu tomento folii tectis. Uredosporis obovatis vel ellipticis, 40–55 × 25–31 mmm.; episporio hyalino, dense minuteque echinulato, 1·5 – 2 mmm. crasso, contentu granuloso, luteo; foraminibus germinis raris, 6–8, obscuris.

Hab.: In foliis vivis *Oleariae Colensoi* Hook. f. Mount Waiopehu, Wellington, New Zealand, 1,700 m. *G. H. C.*

19. **Uredo wharanui** forma sp. nov. (Fig. 124.) Compositae.

II. Soris uredosporiferis hypophyllis, in maculis pallidis, rotundatis, 1 mm. latis, bullatis, rubro-aurantiacis, pulverulentibus diu tomento folii tectis. Uredosporis ellipticis vel obovatis, 35–55 × 26–34 mmm.; episporio hyalino, sparse rustice echinulato, 2 -2·5 mmm. crasso, contentu granuloso, rubro-aurantiaco; foramine germinis non conspicuo.

Hab.: In foliis vivis *Oleariae insignis* Hook. f. Woodside Creek, Wharanui, Marlborough, New Zealand. *E. H. Atkinson.*

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